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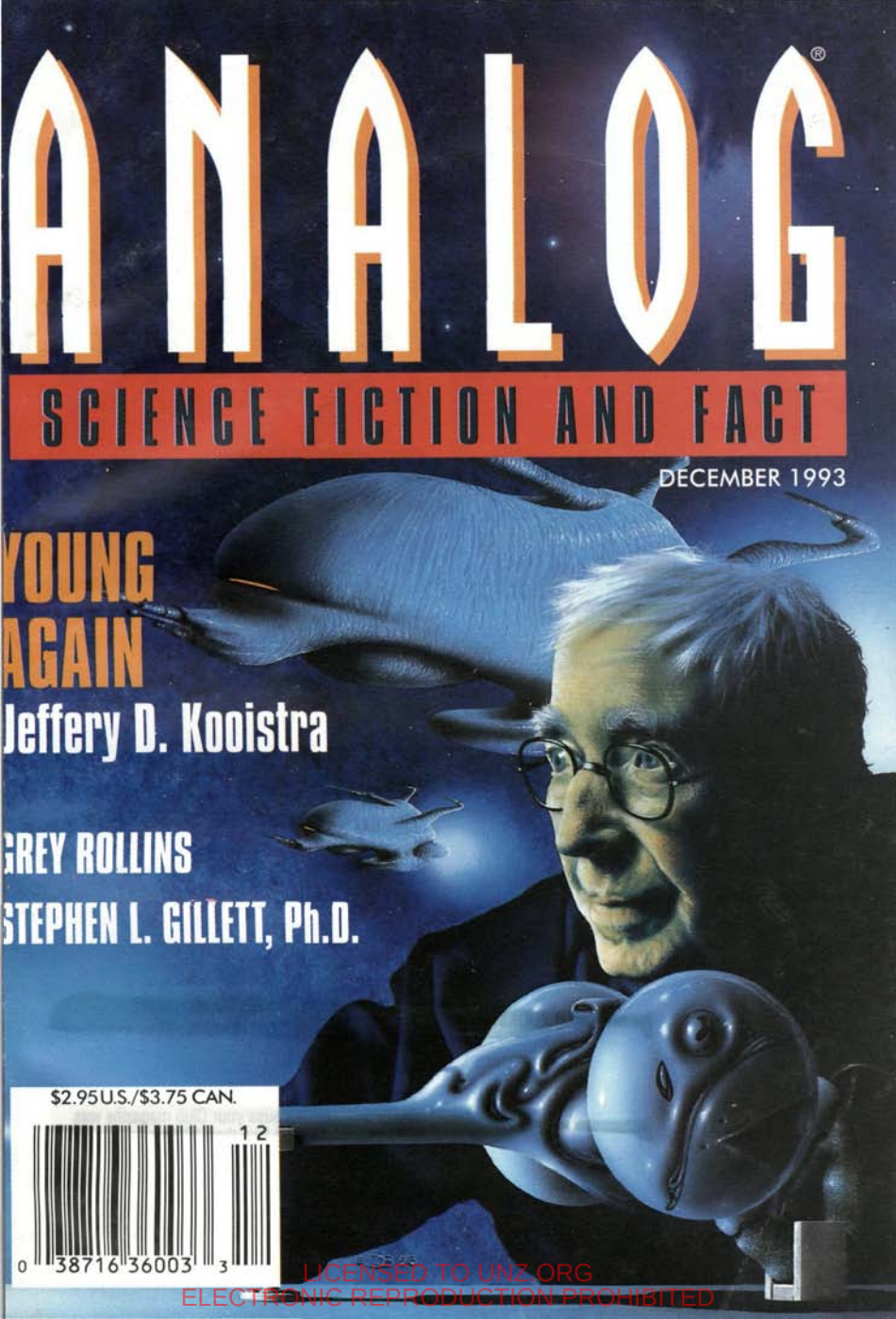

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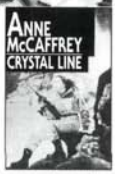

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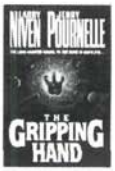

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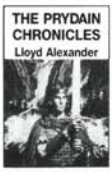

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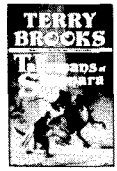

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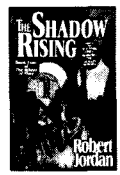

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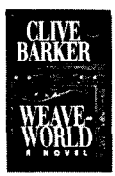

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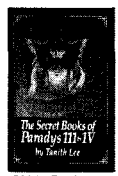

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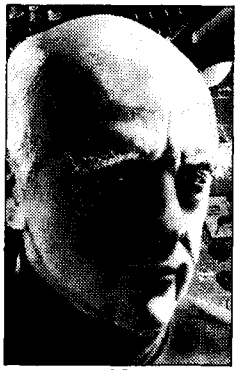

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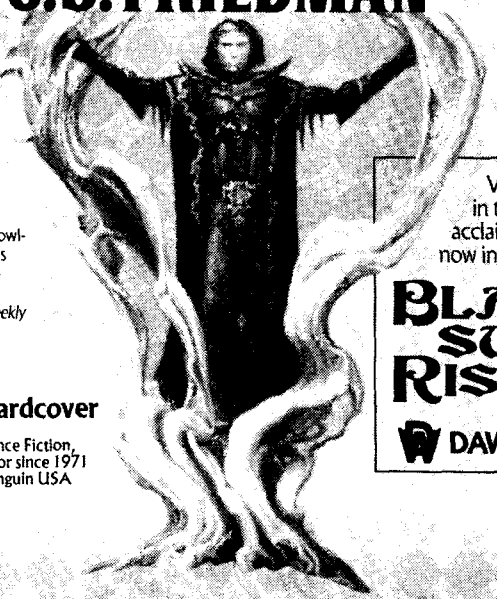

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EDITORIAL Stanley Schmidt

THE IRONIC EPIDEMIC

Since a large percentage of technologies were developed and promoted as labor-saving devices, there's a painful irony in the title and content of a recent report from the UN's International Labor Organization. "Job Stress: The Twentieth Century Disease" describes job-induced stress as a worldwide epidemic affecting people in virtually all countries and all kinds of work. In some countries, notably Japan and the U.S., people are working longer hours than at any time in recent memory, and they're getting still longer. The Japanese language has added a word, *karoshi*, meaning "death by overwork." A survey cited in the ILO report claims 40% of Japanese workers fear that *karoshi* will be their personal fate.

What happened?

How did so many of us get into such a fix? Why are we doing this to ourselves and each other at a time when we're surrounded by more "labor-saving" and "time-saving" devices than ever before? Could it be that these gadgets really *aren't* labor-saving and time-saving?

No, that's not it. At least most of them really are. Just think, for example, of how long it takes to cut lumber for a house with a power saw, compared to doing it by hand; or to farm a field with a combine or a single team of horses. Ask any writer who has had to rewrite an article on a typewriter, and later a similar one on a word processor. Or a scientist who can now do, quite routinely, calculations that in the past could only be roughly approximated, and that at great cost in time and labor.

Modern technologies really do make almost any task dramatically easier and faster. So how can it be that, even as they have become widely used, more and more workers are working longer and harder and showing such symptoms as burnout and high rates of accidents and sickness?

I haven't seen the actual text of the ILO report, but the several articles

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I've seen about it—and about its subject—suggest a number of possible causes. Pressure to keep up with the rapid pace of machines, for instance, as well as workers having too little control over their own jobs and too little pay for too many hours. Another source of pressure is the tendency in many occupations toward "electronic eavesdropping" that lets employers observe quite closely how their employees do their jobs, how fast they do them, and how often and for how long they take breaks. Employers claim this helps maintain efficiency; employees claim it makes them feel harried, as if "Big Brother" is constantly breathing down their necks.

I don't doubt that there is validity in all these suggestions, but I think the articles I've seen so far have missed one of the biggest contributors to the problem. It is this: *new abilities are too readily allowed to create new work.* That may sound like a great thing, but that's only if you're locked into an antiquated mode of thinking that views work and jobs as intrinsically good, desirable, and virtuous. In fact, work and jobs are good, desirable, and virtuous only as means to an end. The value lies not in work *per se,* but in what work produces to make people's lives better.

Improved technologies make it possible to satisfy any given need, such as food, shelter, clothing, or transportation, with less time and work than it used to require. By simple logic, it would seem obvious that people who use those technologies should be able to satisfy all their needs and have more time to do things simply because they *want* to do them—things like read books, watch sunsets, or paint pictures.

The only way that can *not* happen is if people's "needs" increase, and that's exactly what has happened, on several levels. People have convinced themselves, or allowed others to convince them, that they *must* have the Latest Version of everything because it can do something a little better or faster than what they already have. Slick advertisers are in a frantic nonstop race to convince consumers they have new needs; engineers and designers are in a similar race to invent new gadgets that the advertisers can convince people they need. Economists help out by saying all this is Good because making all those faddish new gadgets creates Jobs. Positive feedback keeps the whole pro-

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cess going in an ever-quickening spiral.

The problem is not new. Somewhere around a hundred years ago, an embittered Mark Twain complained that the aftermath of the California Gold Rush had "produced a civilization which has destroyed the simplicity and repose of life; its poetry; its soft, romantic dreams and visions; and replaced them with a money fever, sordid ideals, vulgar ambitions, and a sleep which does not refresh. It has created a thousand useless luxuries and turned them into necessities and satisfied nothing."

Sound familiar? It's not new—but it's almost certainly worse now than ever before. That's because we now have an impressive array of devices that can do old jobs faster and easier—but a machine that can do an old job faster and easier can also do *new* jobs that nobody ever *wanted* to do before. In the heady rush of novelty, almost everybody assumes that if we *can* do it, we *should* do it.

That, I think, is the fundamental fallacy at the root of our present global "work-stress epidemic." The cure, if and when it comes, will involve a paradigm shift in which people will learn to ask questions and make conscious choices about which new jobs that we can do are actually *worth* doing.

That won't be easy. The old ways are too deeply entrenched in the structures of present societies and the emotional attitudes of people who live in them. I suspect that the paradigm shift and resulting changes in social structure will involve, for

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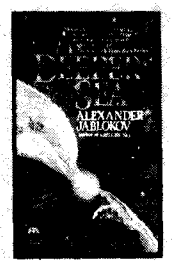

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example, a redefining of the "work ethic." Most of us have grown up thoroughly indoctrinated with the belief that Work is Good, with the implicit corollaries that More Work is Better and one should feel guilty about taking or enjoying leisure. That made a certain amount of sense when there was so much work that had to be done that most people needed to do a lot of it and nobody (except a privileged few) could afford to take much time off. It makes far less sense now. Survival, and even comfort, simply don't require the amounts of human drudgery now that they once did. It's just plain stupid to invent drudgery that serves no purpose beyond keeping people busy, and then pretend that it's virtuous.

We'll still need a work ethic—but a better one. The part we'll still need is the part that says whatever work you do, you do thoroughly, conscientiously, and to the best of your ability. The part we *don't* need—the part that has outlived its usefulness and become counterproductive—is the part that says there's virtue in sheer *quantity* of work or the number of hours you devote to it. You may be paid by the hour, but in fact your hours *as such* have no value at all to your employer or his customers. What has value is what you *do* with those hours. Producing a given quantity of valuable product or service in one hour is more, not less, valuable than producing it in two. And leisure itself is a basic human need, and not necessarily a waste of time. Even from the employer's point of view, employees who get periodic rest and recreation work better than those who don't.

But even if this view of things is right, and even if large numbers of individuals come to believe in it, that won't be enough to make things change. Individuals can't do it alone, because of the competitive forces that compel individuals and institutions to go along even with flows they dislike. (Think of it as "cultural viscosity." In fluids, viscosity means the stationary part of a fluid holds the flowing part back, but it also means the flowing part drags the stationary part along!)

Some people headed for *karoshi* put in far more hours than they're paid for simply because they fear they'll lose their job to someone who does if they don't. Companies keep frantically cranking out new products, whether they're needed or not, because they feel compelled to snatch all the customers they can away from their competitors. Both individuals and companies are forced to adopt new technologies whether they're comfortable with them or not, simply because if they don't they'll lose work to others who do. A freelance musician, for example, can no longer hope to make a living at his art without a telephone answering machine. Prospective employers simply won't bother calling him back very often if they can leave a message on someone else's machine on the first try.

So even if lots of people get fed up with the race to buy more and more things they don't need, and to work longer and more frenzied hours producing things that nobody needs, few of them will be able to get off the

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treadmill alone. My hunch is that growing numbers of people *will* recognize that they're on an unnecessary treadmill, and want off; and that somehow a lot of them eventually will get off, and that paradigm shift will occur. I'm not sure exactly *how* that will happen, but one possible mechanism I can imagine, at least dimly, is a resurgence of unionism or something like it.

Unions aren't as popular now as they once were, and not entirely without reason. Like any organization with a lot of power, they have been known to abuse it on occasion, making and enforcing unreasonable demands. But they arose to fill a real need. Many workers in the late nineteenth century found themselves working under conditions they increasingly (and reasonably) viewed as intolerable. No one of them could expect to do anything about it; if he complained, his boss's answer would be, "You don't like your job? Then leave!" But if *all* the workers said, "Things have to change, or *none* of us work. . . ."

Things changed.

Something like that may happen again—or maybe it will happen in some completely new way. Unionized demands for improved working conditions won't be enough, of course; there's too much else involved. Our competition-driven economy will need to modify that drive and find others. The whole economic system will need to retune itself to thrive on the basis of maximizing quality—of life as well as product—instead of simply striving to maximize production and consumption, no matter what. It's not obvious, at least to me, how that will happen. Something like union action may be the start, but only a start.

But whatever the details, I strongly suspect that something *will* happen. Eventually enough people will recognize that more and faster is not always better, and that much of the work and stress they're enduring is no longer necessary. They'll recognize that labor-saving devices can and should be making their lives easier, not harder, and they'll insist that ways be changed to make them do so.

But the key to it all is that question that both individuals and institutions must start asking as a matter of course: *is this job worth doing?* Sometimes the answer will be yes; sometimes it will be no. What we must learn is to *ask,* to think about the answer, and to embrace those new capabilities that actually make life better while rejecting those that just make it busier. ■

Advice is what we ask for when we already know the answer but wish that we didn't.

Erica Jong

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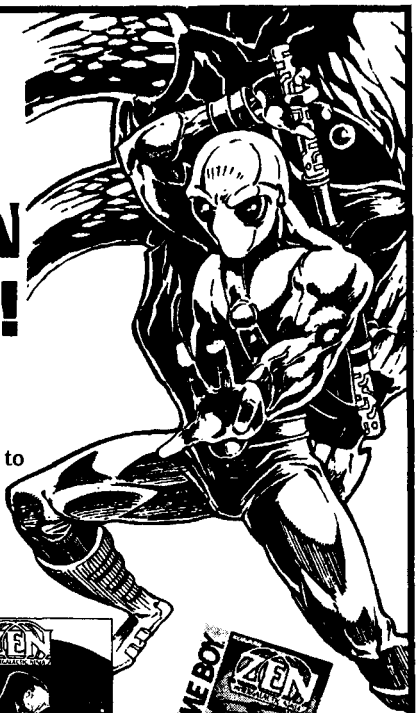

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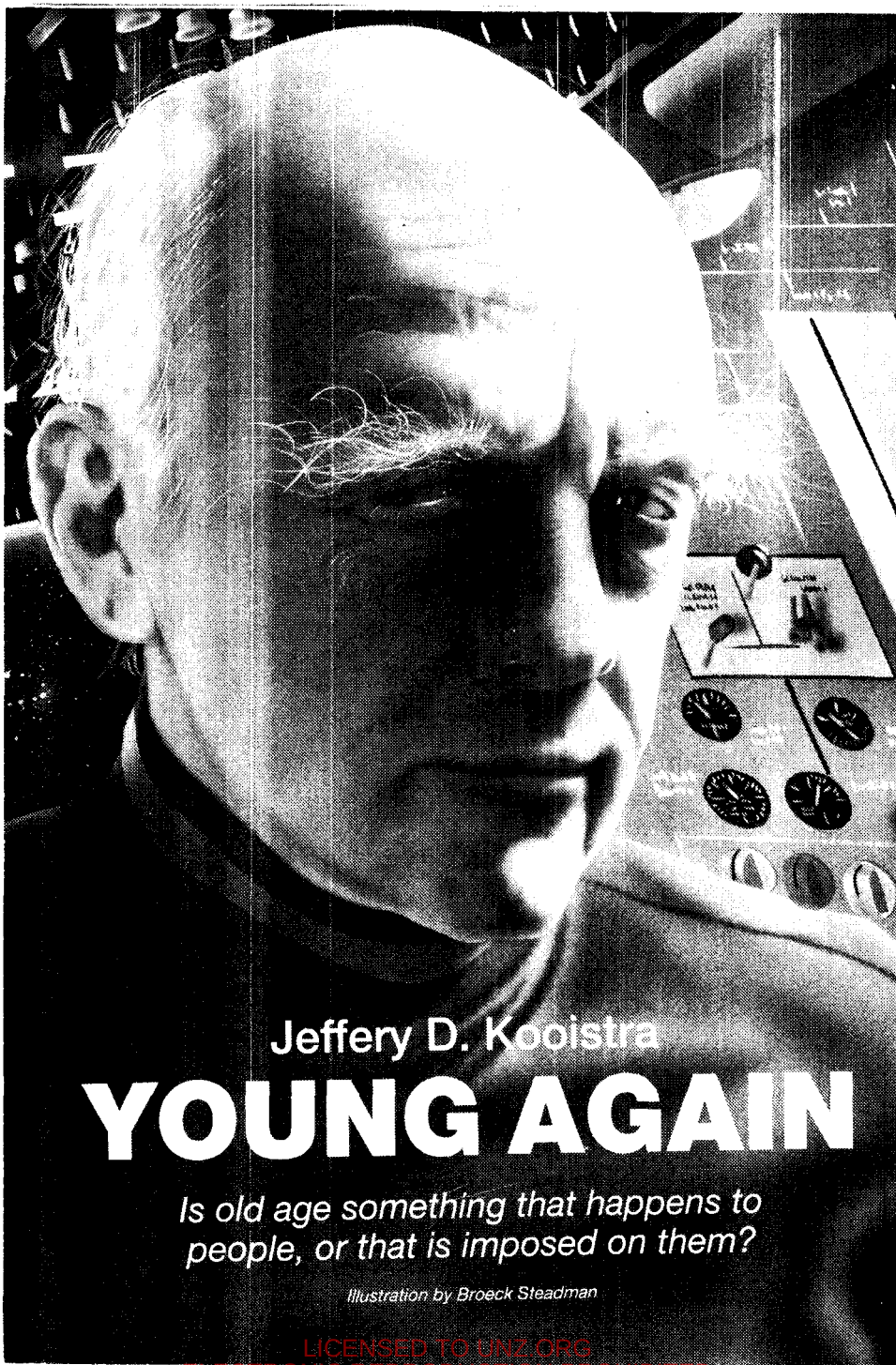

Jeffery D. Kooistra

YOUNG AGAIN

Is old age something that happens to people, or that is imposed on them?

Illustration by Broeck Steadman

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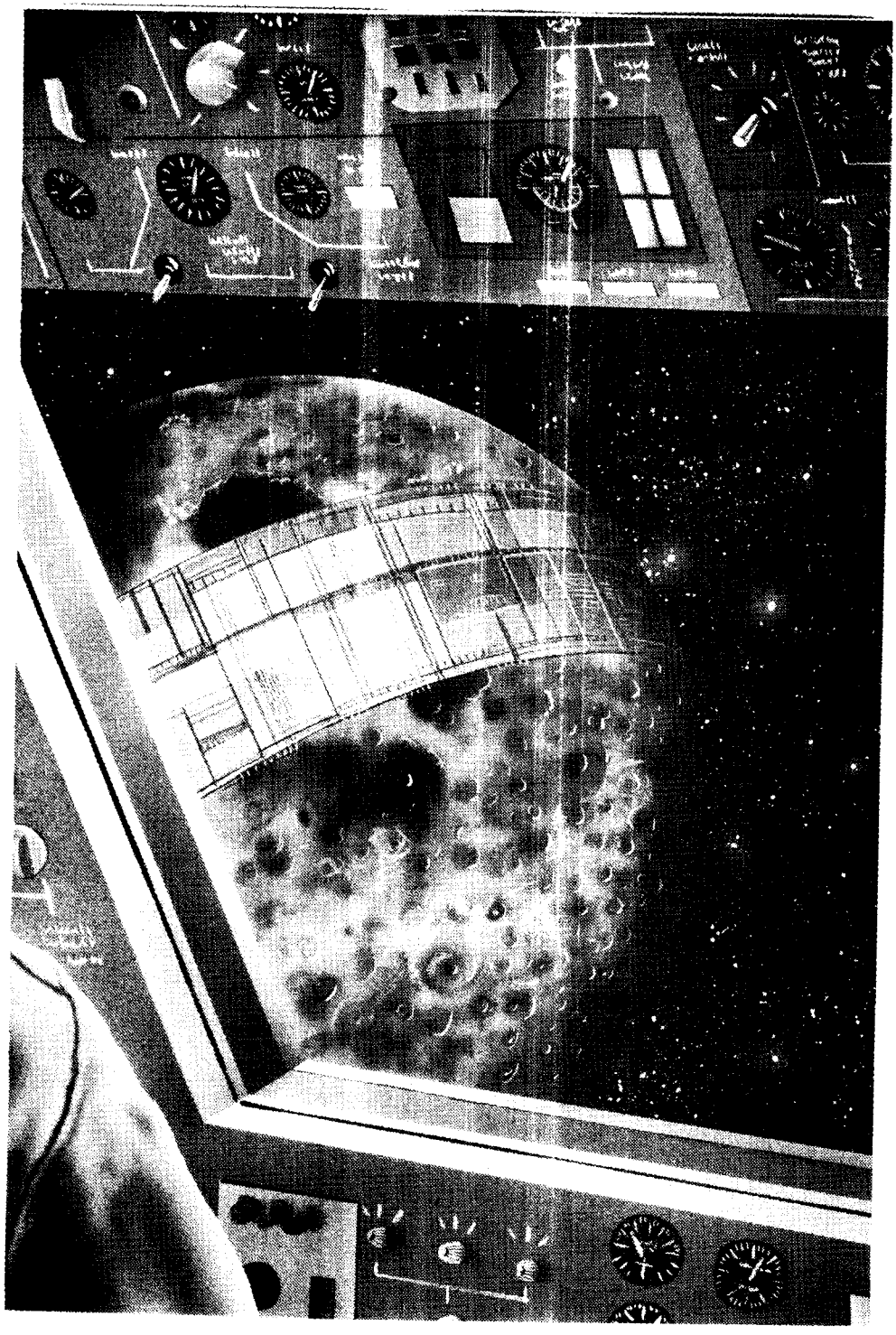

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I

"Well, Professor Dykstra, I recommend that you try using a cane."

"A cane?" the old man said. "The dawn of the 22nd century, and the best that medicine can offer me is a cane?" He said it not with bitterness, or distress, but only ironic amusement.

"I'm sorry, Professor, but you *are* 126 years old. There's a limit to what we can do with muscle and nerve past the century mark," the doctor said.

"That's quite all right. I expected as much. Now, where might one acquire a cane?" Dykstra stood, steadying himself against the chair until sure of his balance.

"I had one brought up for you." *The doctor produced a shiny, titanium* walking stick, with a soft but firm handle and a cushion on the tip. "The stud here on the side adjusts the length." He handed it over.

James Christian Dykstra, the archetypical genius of the age, looked over the walking stick, weighed it in his hand, thrust it firmly into the floor, and said, "Serviceable, but short on character, I think, Doctor."

"You don't like it? But it's the best on the market."

"I have something else in mind," Dykstra said. "But I'll use this one for the time being."

And how much time will that be? he thought as he left the university medical center. He was ancient, well beyond the average age of dying in even this era of extended life, with all his roads traveled and behind him, save one that went on but a short distance ahead.

He decided to walk through the quad rather than summon his car to come get him. It was a beautiful day, after all, cane or no cane.

He saw a student at a picnic table, face buried in a textbook of familiar red, stylus in hand, its tip resting on his computer pad. "May I see what you're working at, young man?" Dykstra asked, walking up to the boy.

The student looked at him. Dykstra wondered what he saw. "If you want . . . sir. It's 4-space physics, the Dykstra field equations," the youth said. *My physics,* Dykstra thought, and it was clear the boy didn't recognize him.

"I recall it well," Dykstra said, examining the book, "from way back in *my early days. Is there some particular* difficulty you're having? Maybe I can help you."

Skepticism clouded the student's face, then a resigned "it's worth a try" look. "Problem 22. I'm clueless."

Dykstra read the problem, then looked away, letting his mind work, seeing if he still had it in him to solve such problems. He had it. "From the symmetry of the situation, what you should do is consider the projection of the 4-space field, its 3-space shadow if you will. Then integrate from zero to pi. The answer is 45.2 joules per meter to the fourth." He smiled, eyes twinkling.

The boy stared at him, his face jumping from pure disbelief to respect bordering on awe. "That's the answer in the back! How did you know?"

"I *see* it in my mind," Dykstra said. "I see the shape of the field."

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"But the only person I've ever heard of who can visualize 4-space is James Christian Dykstra himself."

Dykstra smiled.

"Can I have your autograph?"

Dykstra obliged, though he was embarrassed that his signature was but a shaky shadow of its former self.

He left the boy and continued across the lush lawn to the parking area where his car waited. "Open," he said. The door slid aside. The seat moved outward. He dropped into it and was pulled inside. The car resealed itself. "Home." Gently the car lifted on its Dykstra repulsors, the fields interacting with the matter of the ground to raise the car into the sky and deliver the inventor of Dykstra field physics to his home in the mountains.

Home was a house in a meadow two kilometers up the western side of the Sierra Nevadas. The car grounded and Dykstra went inside, putting the cane aside since another of his inventions—his world changing inventions—reduced the interior gravity to half standard. "Ahhh, home sweet home."

James Christian Dykstra, acclaimed by the whole Solar System as the smartest man in the world, was feeling his age. He accepted it philosophically, that he was old, that his days were numbered. But he had made more than his share of marks on human civilization . . . when he was younger.

He sat down in his favorite chair, looking out the window past the meadow and into the distance where the Sun was creeping toward the horizon, and reminisced—the old man's entertainment.

He remembered those wild days in college, before the Collapse at the end of the 20th century, with his friends Jamie and Jenny. Ah, Jenny—she'd written his biography. She'd loved him, but he could never return it. And the Collapse years, the desperation, and then the Moon Rush following, when he'd been instrumental in getting people to return to space to stay. He recalled his meeting with Paul McAndrew, the first protestant saint. The man had shaken his hand, then looked at him funny, and said, "You are James Christian Dykstra, and through you God will give Man the stars." The memory still sent shivers through him.

The prophecy had come true, after a fashion. Dykstra field physics had made possible so many dreams of science fiction. Force shields, artificial gravity, repulsor beams, cheap fusion—all of these had resulted from his genius. With his inventions and his physics had come new weapons, weapons that the Belt was now using against the Solar Union. He felt bad about that. But humans will be humans.

Still, if mankind reached the stars it would be by leaping off his giant shoulders. But he wouldn't be around to see it.

He sighed.

Rousing himself from his memories, and from his chair, he went into the kitchen.

A package sat on the table, a System Patrol courier container. There was a spot for a thumb print on the top. If

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it was coded for his print, the package would open at his touch. If not, high explosives would detonate, taking out him and most of the house, too.

He placed his thumb on the pad.

The hemispherical endcaps of the container slowly separated, then the middle section split at the top and folded out. Inside was a data cube and a decidedly odd looking implement, which reminded Dykstra of a hand weapon, though it wouldn't fit a hand properly. A tube projected from one end of the thing, out of the main bulk of two ten-centimeter diameter spheres and a heavy, padded loop—a handle, perhaps.

Dykstra left the implement in the container and took the data cube to his terminal. The cube booted and he redirected the output to his TV screen, which covered half the north wall.

A man in a major's uniform appeared. "Hello, Professor Dykstra. I am Major Gerald Moore of System Patrol Intelligence. Within this cube you will find all the data we've been able to wrestle out of the device in the courier container. It's extremely dangerous, so I'd recommend that you follow the operating instructions our boys were able to come up with before handling it. We lost a man finding out how to work the thing.

"The device is a weapon of extraterrestrial manufacture. That's right, we've encountered aliens. That fact is not for public consumption. You know what that means. The story of how we came into possession of the device is also in this cube.

"Intelligence has been able to find out how to work the weapon, but not how it *works*. We know how to fire it, how to adjust the length of the beam, and how to adjust the beam intensity. We also know that the beam itself is an X-ray laser. But how the beam is generated is beyond us. The weapon uses Dykstra fields in a way we've never seen before.

"Beyond that, its power source is a mystery—it doesn't seem to *use* anything; not batteries, not capacitors, not nuclear micropiles, not mini fusion generators, and not chips of antimatter.

"We hope you can help us out, Professor.

"One other thing—the aliens are hostile. They opened fire on the first human ship they met, out in the Oort cloud. Their technology is beyond ours. God help us if they take us to war.

"As of viewing this message, you are recalled to active status, Professor Dykstra, under the Wartime Civilian Service Act. We have a place all ready for you at the Patrol High Command on Luna. But for now we'll leave you alone for one week. My courier will contact you on the 21st.

"Good day, Professor."

They need me. The thought made him happy. He hadn't worked for the military since he was in his nineties, but not for lack of offering on his part. The System Patrol had always treated him politely when he suggested that he might still be of help to them on some technical matter, but always with polite refusals. Only last year, the Belt, just before the start of the

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war, had demonstrated the ability to produce antimatter in vast quantities, tons at a time it looked like. Dykstra had received the news through some old friends on the inside. The knowledge that such a thing *could* be done had set his mind to racing, playing over the possibilities, and in a short time he was ready to make his pitch to the Patrol. He needed intelligence data and the proper facilities, but he was certain he could duplicate the Belt process.

They stiffed him, told him no, said they had their own people working on it, with the underlying implication that he should be content to be a legend and quit bothering them.

"And now you need me, Major Moore." He wasted no time on bitterness over the past, nor gloated that they came to him now. But success, and thus vindication, would taste sweet indeed. He smiled.

"So let us see what else is in this cube." He raced through the contents. Later he would go back for a more thorough investigation, but for now he simply wanted to see what they'd delivered to him.

The speed with which Dykstra perused the information was astonishing, not just for an old man, but for any man. His IQ had never been adequately measured—he never missed any questions on the tests, never reached his limits. One tester, in frustration, had simply written "IQ of 300" across the top of Dykstra's score sheet and let it go at that. There had simply never been anyone in the age of mental testing with his raw intellectual ability.

"Ah, very interesting." Dykstra was watching visual scenes of the weapon being tested. There were its parts, disassembled—it looked remarkably simple. There were three men out in a field, test firing, manipulating the settings to make the beam change length from less than a meter to unlimited. There were scenes of the weapon being tested against targets—a fifteen centimeter thick steel beam, sliced in two effortlessly; a three-meter wide crater blasted into a granite mountainside; a one hundred thousand liter tank of water brought to the boiling point, and entirely evaporated, and the gun still not short of energy.

He looked away from the screen to his table, to the alien weapon sitting there, innocently hiding its secrets, daring him to pry them out.

Walking to the table, he picked up the weapon. "You will not defeat me," he said, but he smiled at it with admiration.

He caught a glint of light out of the corner of his eye. It was the shiny titanium walking stick, leaning securely in the corner by the door. Characterless.

With a twinkle in his sharp eyes, Dykstra carried the gun with him, took the cane in his right hand, and went outside. "Now is as good a time as any to start my tests," he said to the squirrels playing tag around the trunk of an ancient oak.

The cane was a help, he had to admit, walking out here in a full *g* field. Crossing his yard he approached the edge of the woods. He had a particular branch on a particu-

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lar young oak in mind. Ah—there it was.

He leaned his cane against a neighboring tree and examined the weapon. If the instructions were correct, then moving this lever to *here* and touching this stud just . . . *so* . . . *Fisssss!* Out came the beam, glowing brightly, too bright to look at for more than an instant. Dykstra's careful eye estimated the length at eighty-five centimeters.

Somewhere behind his eyes, though almost visible to him, his mind started the process of figuring out how the weapon controlled the length of the beam. He couldn't help it—his mind had always worked that way.

He brought the beam against the base of the limb, quickly, and with a brief burst of flame and a blast of superheated smoke, the branch fell to the ground.

"Marvelous!"

Dykstra took his walking stick from the tree and laid it down alongside the branch, measuring. With another flick of the beam he cut the branch to the desired length. As if born to it, Dykstra played the beam against the branch, severing the remaining branchlets, baking off the bark, delicately charring the surface.

The twinkle still in his eyes, he turned off the beam, then reached down for his creation. It was warm to the touch, but not too hot to hold. It left black marks on his palms, but he didn't care. "I'll have to clean you off, and sand you a bit, and give you a coat of wax," he said to the stick.

But carved from a living oak with an alien weapon—the world's first alien weapon—and shaped by his own hands. . . . Now there was a walking stick with *character.*

Very late at night, in his shop, with a half consumed and long forgotten cup of coffee sitting pointlessly well within reach, Dykstra was stymied. In two days Moore's courier would contact him, and he'd be on his way to the Moon. But he'd done no packing yet, hadn't even thought about it. The weapon consumed him.

It had yielded up its secrets with difficulty, and some still escaped him, but yielded up secrets it had. He knew how the beam length was controlled now, knew how the energy of the x-ray photons arriving at the terminating point was returned to the source. The application of Dykstra fields (he wondered what the aliens called them) was ingenious and unique, but on Earth they were his baby after all, and no matter what new wrinkles the aliens may have thought up for them, he was sure he could smooth them into understanding.

The power source—that was a tricky one. The weapon used mass conversion, turned matter directly into energy, without any of the fuss and bother of fusion, or nucleus splitting, or combining particles and antiparticles. Any kind of matter would do, but in an atmosphere the weapon just used air molecules. *How* it converted the matter into energy his mind hadn't finished sorting out yet, but he had clues.

But what stymied him now, what

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had gotten him out of bed after three desperate attempts to shut his brain off and go to sleep, was Dykstra's complete inability to understand why the weapon *didn't* do something.

The X-ray laser beam had a diameter of 4.238 millimeters. Its projection length could be adjusted from 72.586 centimeters to infinity. The beam intensity could be adjusted from night light to fusion bomb. "So why in the world didn't they make it so you could adjust the beam diameter and the collimation?" Dykstra muttered for the hundredth time. "It would be trivial to add those characteristics. Why didn't they? Didn't they think there would ever arise a time when a microfine beam might be desirable? Could they never foresee a reason to make the beam disperse?

"Did they just plain *miss* it, or am I missing something?"

By his estimate, the alien technology was seventy-five to one hundred years ahead of human achievement. Why not a thousand? He couldn't answer that question. But why didn't they add those features?

The coffee remained, pointlessly, well within reach.

II

"Good morning, Professor Dykstra. I'm Lt. Robert Nachtegall."

"Yes. Major Moore's courier. I've been expecting you. And I prefer 'Doctor.' " The young man stood outside the front door. Dykstra had watched the lieutenant come down onto his mountain, watched the sleek military courier vessel as it dropped below hypersonic speeds way out over the valley and then gently floated down to the meadow that was Dykstra's yard. He had curly blond hair and clear blue eyes, and looked like a nice enough sort. "I'm ready to go."

"What?" Nachtegall said, surprised. "I thought—"

"No, young man. I'm ready to go now. I presume I can find additional clothing on Luna, so everything in that suitcase over there is all I intend to take. Oh, and this cane, too."

"Very well," the lieutenant smiled. "Also, the device. . . ?"

"All packed up in its container. It's on my table. Would you mind getting it while I collect up my suitcase?"

"Not at all."

Presently they were back on the front porch. "House, seal up command Alpha. Standard stand down procedure." Locks gave out audible clicks as they snapped into place. "That should hold her until I return," Dykstra said. "That is, if I return." He smiled at Nachtegall. "At my age you never know."

"I'm sure you'll be returning, Doctor."

"We shall see."

Proceeding across the meadow, half-way there Nachtegall finally insisted on carrying Dykstra's suitcase for him. The old scientist raised no protest. They boarded the craft.

"Care to ride up front, Doctor? There's an extra seat."

Delighted, Dykstra said, "I'd like that very much. But isn't it against regulations? It was the last time I did military work."

"Wellll . . . yes it is. But if I tell them you insisted . . . ?" The question was in his eyes as well as his tone.

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"Sonny, I insist you allow me to ride up front."

"Very well, Doctor, but it's against regulations." They both laughed.

Dykstra snugged himself into the chair and looked out the windscreen. *Earth up close,* he thought. *It may be a long time before I see her this close again.*

"I'm setting the internal gravity to half standard, Dr. Dykstra—"

"I've changed my mind about that. Would you mind calling me Chris? I'm going to get 'Dr. Dykstra'd' to death soon."

"OK, Chris. Anyway, this boat has full compensation fields so you won't feel a bit of acceleration—" Nachtegall stopped. "Uh, you know all this, don't you?"

"I invented the system fifty years ago, Lieutenant."

"Bob. Call me Bob."

The craft lifted gently from the meadow on her Dykstra repulsors, then climbed rapidly riding the atmosphere jets until it reached thirty kilometers altitude. Once there, Nachtegall was legally permitted to activate the drive, and hot plasma blasted out of the tubes, heated by a speck of antimatter.

"We'll do this trip at three *g*s, Chris," Nachtegall said after they'd cleared atmosphere and Dykstra was enjoying the stars splayed out before him. "A couple of hours from now we'll be dirtside again at the High Command."

"Good."

They filled the time with conversation. Though more than a hundred years older than the lieutenant, Dykstra found it easy to talk to the young man, who was refreshingly free from the sort of intimidation that most people felt whenever they talked to "the smartest man in the world."

They talked about the war. Nachtegall resented being stuck as a courier while there was a war on, even though he felt that this war with the Belt was unfortunate.

Though animosity had existed between the Solar Union, consisting of the four inner planets and the major moons of the outer planets, and the Belt since the latter had won its independence a half century before, it had rarely escalated beyond minor skirmishes.

But this time things had gotten out of hand.

The gas giants have complex satellite systems. Along with large moons over 300 kilometers in diameter, the big planets also have a plethora of smaller moonlets and rocks. Jupiter has practically its own asteroid belt consisting of rocks less than a kilometer across. The Solar Union claimed those rocks belonged to it. But when large heavy metal strikes were made in the Jovian belt, the Belt decided to challenge that claim.

Negotiations went nowhere, shots were fired, and the war was on.

"Now, don't get me wrong. I'm as patriotic as they come. But this 'war of the little rocks' is damn silly. Who cares if the Belt skims a little from the Jovian belt? There's plenty to go around. Besides that, Ganymede's a cesspool. Still, I've got my request in for a position closer to the actual hostilities. If there's going to be a war

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anyway, I'd rather be fighting than ferrying. No offense, Chris. It's not your fault I have this job."

They went on to discussing the aliens. Dykstra found Nachtegall less inclined to speak his mind on that topic. "I've met Richard Michaels," Nachtegall said. "You know, the guy that actually ran up against the aliens out in the Oort cloud. They spook me, Chris. I was always taught that there probably weren't many technological civilizations out in the Universe, maybe none besides us. If there were, we'd see some kind of evidence—Dyson spheres, radio signals, something. But we never found anything like that, not in more than a century of looking.

"And then just when the Universe looks empty they show up on Michaels's doorstep and blast their way inside. They don't seem interested in communicating, they don't—aw, hell, you'll just have to talk to Michaels about it. He says they didn't do anything that made any *sense*."

After that Dykstra told the lieutenant about the old days: the Collapse, the excitement of the Moon Rush days, the Belt War of Independence.

But not what it was like to be 126 years old. Dykstra didn't bring it up, and Nachtegall was tactful enough not to ask.

"Luna City just off to the left, Chris."

"She's so much bigger now. Four more surface domes, dozens of connecting tunnels—the landing field is three times bigger than the last time I was there. I've watched her grow through my telescope back home." Dykstra smiled serenely. In some ways, this was "back home," too.

"We'll be grounding in ten *minutes*."

Smoothly the boat descended. They flew into the mouth of the artificial cave that was the berthing area for the System Patrol small craft. Nachtegall set them down without a bump.

"All ashore that's going ashore," Nachtegall said.

They left the boat. Dykstra remembered to put his cane out first, using it to help him stand. "I see they still keep System Patrol installations at one *g*," he said.

"It keeps the troops in fighting form. You invented artificial gravity, too, right?" Nachtegall said.

"Yes. Paying for it now, though, aren't I?" The man from the message was waiting. Dykstra recognized the major immediately.

"Professor Dykstra, greetings. I'm Major Moore. Welcome to the Moon."

"Thank you, Major. It's good to be here. But call me 'Doctor.'"

Moore noticed the cane. "What's that?"

"My cane, Major. I have difficulty getting around in full *g* fields without assistance. My doctor suggested a cane."

"But it's—a stick. Your doctor gave you a stick?"

"I *made* this stick, Major. I prefer it to a sterile titanium rod." Dykstra watched Moore closely, noting his expressions.

Moore hesitated after Dykstra's

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comment, perhaps afraid he'd irritated the old professor. *He's uncomfortable with me,* Dykstra thought. *He only knows me by reputation, but now that he's seen me, he doesn't know if I've still got it. Or maybe he's afraid I'm a crazy old coot. We shall see, Major, whether or not I've still got it. We both shall see.*

"We should get you situated in your room, Dr. Dykstra. Take him to his quarters, Lieutenant."

"Yes, sir." Nachtegall carried Dykstra's suitcase and the two proceeded through the vast labyrinth of the High Command complex until they came up to an ordinary door well down the eighth distinct corridor (Dykstra counted) they'd traveled.

"Put your palm on the ID plate, Chris." Dykstra did so. The door opened. "It's keyed to your handprint only," Nachtegall said. "That's not at all common for rooms here. They want you to feel special."

They went inside.

Room. Lots of room. Dykstra's experienced eye picked out the luxury items: the first class work station with more computing power than he had at the University; the first class autochef, capable of preparing any kind of food that an old, delicate constitution might require; and the gravity dial.

Nachtegall went to the control and turned the internal gravity down to half standard. "Is that good enough? If you want, I can kill all the pseudo gravity and you can have Luna standard. But they didn't rig this room for null *g*—it'd cause too many problems with the floors above."

"Quite all right, Bob," Dykstra said. "These are unusually nice quarters—how many others are there like it?"

"None. Well, maybe the commander's. I don't know. I've never seen his place. Like I said, they want you to feel special."

"Why?"

"Because The Phinon Project isn't getting anywhere, Chris. Calling you in was the last good idea anyone has had in a month."

"What is 'The Phinon Project'? The aliens? I'm not familiar with the origin of the name."

"It's a cobbled together name. The 'phi' part is just the Greek letter. The 'non' part is short for 'nonsense.' The first nonsense project was called Alpha Nonsense, and so on."

"Why 'nonsense' project?"

"System Patrol Intelligence started some speculative projects about twenty years ago. If something comes along that fits with the project, it already has a program to cover it. The nonsense designation came because some of the ideas are pretty far out. The Gamma Nonsense Project was for investigating unlikely advances in energy technologies. The Belt antimatter successes are dealt with under that one. The Phi Nonsense Project was for alien contact, hence, Phinon. Some of the guys are already referring to the aliens as 'Phinons.' I suppose it will stick."

"And you say the project is getting nowhere?" Dykstra continued as he took a seat on the comfy chair. The lieutenant sat down opposite him on the couch.

"That's right. I'm not a scientist, but

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working this close to Major Moore I picked up a lot of things, mainly from having frustrated Ph.D.'s use me as a sounding board. They've had successes, sure. They understand to a dozen decimal places what the alien technology—the weapon and some other things we got back from the Oort cloud—can do. But figuring out how they accomplish these things has remained beyond them."

"I have my work cut out for me," Dykstra said.

"I'd say so." Nachtegall stood, checked the time, said, "I have to leave now. I'll be back tomorrow morning, say, 900 hours? I'm supposed to be at your beck and call for the next two days. So if you need me for anything. . . ."

"Very well, Bob."

Nachtegall left and Dykstra set the autochef to prepare a meal. While waiting, he checked out the work station. A few commands assured him he had full access to The Phinon Project files. He found a section on the biology of the aliens that hadn't been included in the cube Moore had sent him. The aliens had steel skeletons, and in place of muscles, they used a system of hydraulics. Dykstra, fascinated, lost himself in the information.

Lunch was forgotten and grew cold.

III

"May I come in, Doctor?"

"Certainly, Major Moore." Dykstra led the man to a seat.

"I understand you have something to discuss with me?"

"Names, Major. Among your duties is the recruitment of special talent for the Intelligence branch?"

"Yes. Do you have someone in mind?"

"I have many people in mind. I made a list." Dykstra handed over a printout.

"I don't recognize any of these names," Moore said.

"I didn't expect you to. All of these individuals are very young, practically just out of graduate school. They haven't had time to make their big marks yet. But I've read their research papers.

"Those names are of individuals who are brilliant." Moore couldn't doubt him. "You should recruit them for The Phinon Project. We'll need them."

"Well, I respect your opinion, Doctor. But some of these disciplines don't fit into what we're doing. This first one, Samantha MacTavish, genano engineer. How could she help us?"

"She's the biggest prize, Major. The aliens have steel skeletons. Doctor MacTavish is currently involved in genano research aimed at separating iron oxide into its constituent elements using bacteria/virus/nanomachine hybrids. Besides that, she has an exceedingly rare form of intuitive genius. She'll think of lots of things that we can't."

Major Moore looked skeptical. Finally, he said, "I'll see what the budget can handle, Doctor. But I won't make any promises."

"Go after Dr. MacTavish first."

Looking annoyed, Moore said, "Right."

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Missing the signals, Dykstra pressed on. "If you have any difficulties with the requests, Major, I'm sure I can convince the holders of the purse strings just how badly we need these individuals."

"How's that, Doctor? Is that a veiled suggestion that you'll go over my head if I don't talk to these people?"

He's angry . . . thinks I'm trying to run his show. "Now Major, that's hardly fair. I've said nothing of the sort. But I did get the impression that you were brushing off my suggestions. That would be terribly unwise," Dykstra said, unconsciously leaving open the question of what he *meant* by *"unwise."*

"I'm sorry for the misunderstanding, Doctor." Moore smiled. Barely.

"No harm done. Will you be at my seminar tomorrow, Major? I've made some valuable progress in my week here."

"I'll be there, Doctor."

Lt. Nachtegall was running late, which was evident from the way he tore down the corridors of the High Command on his way to Dykstra's seminar.

"Where's the fire, lieutenant?" an ensign called after him. He was ignored.

He'd planned to make the seminar in plenty of time. Chris hadn't said what he intended to present, but had made it plain that at least one bombshell was in the offing. Nachtegall wouldn't have missed it for anything.

He'd thought.

The call had come just before he was going to leave, direct from General Hadella, the Czar of Special Operations. He'd gotten a mission! Top secret, very hush-hush. He'd be leaving for the Belt in three days as pilot for a behind the lines raid.

He was finally going to get in the war big time.

The seminar was just starting. He slipped through the back door and quietly took a seat. Dykstra, cane in hand, was gesturing at some items on the projection screen that were meaningless to the lieutenant—all mystical symbols and misshapen letters, and here and there an equals sign. Dykstra needed the cane anyway since the gravity in the room wasn't adjustable, but the old scientist was so animated that Nachtegall never saw it touch the floor, except when Dykstra set it aside to deal with some equipment on the table before him.

"Did you follow any of that?" Nachtegall heard one scientist whisper to another.

"Maybe half. Every other letter, I think," came the reply.

"Here we have the alien weapon," Dykstra was saying. The device was mounted on a stand. "You've seen it many times already, and I have many of you to thank for determining a safe method for operating it." He moved down the table to another device, this one unfamiliar to Nachtegall, and considering the murmurings he heard, apparently unfamiliar to all.

"I know some of you wonder about my solitary working methods. I never meant to leave any of you out, but I

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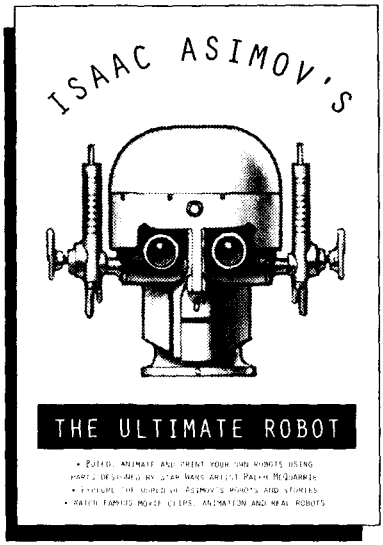

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had a lot of catching up to do, and I do better on my own in such instances." Nachtegall smiled at that. What Chris meant was that he didn't need a lot of dimwits in his way distracting him while he sorted things out. "But I will be working closely with you from now on. I'd like to show you some of the things I've found out."

Dykstra flipped a switch, and a light lit on the unfamiliar apparatus. "This, gentlemen, is my attempt to copy the alien weapon." Nachtegall studied the reaction in the room. No one said anything, but there was a change in the atmosphere. A few faces were scowling, perhaps in disbelief that anyone, Dykstra included, could have duplicated the weapon. None of them had been able to do so. Others waited with anticipation, wondering at what the legend had done.

"First, the original," Dykstra said. He tripped the trigger and it bored a neat hole through a three centimeter thick block of ceramsteel before terminating in its no longer mysterious way. He returned to his own device. It bored a neat hole also. "Now, this in itself is no big deal—X-ray lasers are old hat. But my beam is generated the same way the alien weapon does it."

"You've figured out how it works?!" The exclamation came from down front. "How?"

"How it does it, or how I figured it out?" Dykstra asked.

"Uh . . . both."

"The first question is answered in the report you will be given at the conclusion of the seminar. As for the second . . . well, I invented Dykstra field physics. The aliens have developed some interesting tricks that I never noticed before, but once I saw what they'd done, the pieces fell into place."

"I'm in awe," the scientist by Nachtegall whispered to the other.

"Me, too," the other replied.

Nachtegall didn't know what to think. He knew he wasn't capable of judging just how incredible a thing it was Dykstra had achieved. He had to settle for judging the reactions of the others, people who had a real understanding of what was involved.

So far they seemed amazed, though some faces looked positively dour.

"Doctor Dykstra?" A young scientist stood up.

"Yes, Dr. Vander Kam?"

The man looked surprised. "You know my name? But we've never met."

"You're Rick Vander Kam, heir to the Capitol Products fortune. I worked for your great grandfather. I've also studied your work—you're very talented."

Vander Kam brightened three shades of red.

"You had a question?"

"Yes. I'm almost afraid to ask, but how are you powering your device? I don't see a power conduit or a fusion pack or anything."

Dykstra smiled. Nachtegall could see the triumphant twinkle in his eyes from all the way in back. "Total mass conversion, Dr. Vander Kam. I duplicated that process, too."

"What?" "I don't believe it!" "Most holy shit!" Shocked disbelief. Ques-

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tions were fired at Dykstra, he answered them simply, still with that twinkle in his eye—he was thoroughly enjoying himself. After five minutes Nachtegall sorted out the gist of what Dykstra had accomplished:

1) He had leapfrogged all the work of the Gamma Nonsense project, for cheap antimatter production was a trivial spin-off of Dykstra's development, and also now obsolete.

2) He had not only deciphered the alien technology, but duplicated it with terrestrial means right at hand, and all by himself. That really galled some of the gathering.

Nachtegall looked at Major Moore, seated off to the side. The Major was not smiling. *Now what's his problem,* Nachtegall wondered. He knew Moore hadn't wanted Dykstra to be given the star treatment, had felt that it might interfere with his authority, and had been overruled. Now Dykstra had managed to outshine even the brightest of the early hopes for what he might accomplish.

Dykstra was tapping his cane on the table. "Quiet, please. Quiet. This seminar is not over yet. I have some other matters to discuss. I need to point out a problem I'm having in understanding the alien design philosophy. It may shed light on the alien thought processes themselves."

The room came to order, though Nachtegall could still see half a dozen conversations continuing in whispers.

Dykstra stood again by his device. "I want to show you one other thing that my copy does." A few changes were made to settings and then the beam reappeared, truncating at eighty centimeters. But instead of a thin cylinder, the beam was now a tight cone, the apex at the point of emergence. Dykstra slid the ceramsteel block against the base of the cone, then backed it away to show the large hole bored through the block. "You see—by allowing the beam to spread, I am now able to make a bigger hole in the block. There are other possible uses for a variable collimation of the beam. I'm sure many of you could think up particularly nasty applications.

"Now here's the rub—the alien weapon can't do this."

There was silence while Dykstra scanned the room, and Nachtegall could almost hear the collective thought of "So, what's your point?"

Vander Kam spoke up. "But even your first duplication attempt has that feature. I gather it isn't difficult to do?"

Dykstra smiled. "Very much correct, Dr. Vander Kam. Adding adjustable beam collimation is altogether trivial. The question is why the aliens didn't do it."

Another older scientist stood up, Dr. Manlinkov, looking like the original Russian bear. He'd begun the seminar with a neutral look that had soured into anger as Dykstra's success became apparent. "Now one damn minute! What the hell does this have to do with anything? Aliens chose not to collimate beam. So what? We're not in position to question what seems to them reasonable—we know nothing about them.

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To speculate will be utter waste of time!"

"I see no chains confining you to your seat, Dr. Manlinkov. Perhaps you would like to get back to *your* investigations of the alien technology?"

Nachtegall struggled to keep from laughing. Dykstra had said the words so sincerely, but everyone knew that Manlinkov had been working on the alien power supply, and getting nowhere, for months. He was just being petty.

"Hmph!" Manlinkov said, and sat down.

Dykstra continued. "I think what Dr. Manlinkov is concerned about is that the aliens' failure to add adjustable collimation may be like our reasons for not making every shotgun double-barreled.

"I am convinced that there's more to it than that.

"Suppose you were wandering the old West and you found what you thought was a six shooter. Upon closer inspection, you discover that the cylinder has only one chamber drilled in it. Now, the cylinder is able to rotate, and there is ample room for five more chambers, and everything works exactly as a six shooter should, except for that deficit in the number of chambers.

"Clearly, adding five more chambers would make the gun a better weapon. So why didn't the maker do it? Did he have some powerful reason for boring only one chamber? Or did it simply never occur to him to bore five more?"

"That doesn't make sense," Major Moore called out. "How could anyone who could make the gun in the first place be so stupid as to miss something like that?"

"I don't know," Dykstra said. "But consider this: Dr. Manlinkov mentioned that the aliens chose not to add the variable collimation feature. Perhaps there was no choice involved at all."

IV

"I don't know where I'm going, Chris," Nachtegall said. "They gave me the coordinates to some anonymous rock no one's ever heard of—but no indication about what we're supposed to do there." They were sitting in Dykstra's living room a day after the seminar.

"Did you meet any of your teammates yet?"

"Yes. Four are cybernetically-enhanced commandos. The commander, Capt. Reynolds, is made out of some very fine steel indeed. The two other team members are medical doctors."

"Really?" Dykstra said, curious. "Do you recall their names?"

"Oh, boy, let me think. One had curly blonde hair... Mary Beth Doelder, a surgeon. The other one, Diane something... Joseph? No, Joswick. Diane Joswick."

"She's not a surgeon," Dykstra said.

"No. A psychiatrist. You've heard of her?"

"Yes. She's *the* name in autism research."

"Then what's she doing in the Patrol?"

Dykstra shrugged.

"The whole thing is goofy," Nach-

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tegall said. "But at least it's a real mission."

"Courier days finished, Bob?"

"Nope. I'll be back with Moore in a few weeks."

Dykstra smiled. He looked good, Nachtegall thought. Relaxed, at peace, enjoying himself. And more. He looked like a man at the peak of his powers, and wise enough to know and relish it.

Dykstra was gesturing with his cane. "This mission is a puzzle. Let's figure it out. You were chosen as pilot because you're already familiar with both The Phinon Project and the Belt antimatter investigations?"

"Yeah. And I'm a damn good pilot, too."

"I wasn't implying otherwise. And I'm beginning to get an idea. Have you seen your ship yet?"

"A Capitol Products Streak Bomber. Oversized engines, but no bomb payload. It looks like we'll be going in fast and coming out fast. But without bombs we're not going on a secret demolition mission."

"You also wouldn't be bringing along Joswick," Dykstra said.

"So? What? We're going to steal something? . . . or someone?"

"That's my guess," Dykstra said. "You're going in to kidnap someone from the Belt. Someone that is very valuable to them, or to us, or perhaps to both."

The lieutenant went to fix himself a drink, also drawing a coffee refill for Dykstra. "Any idea who?" Nachtegall asked, resuming his seat.

"The man responsible for the Belt antimatter successes. I can think of only one person who could have sorted it out. He lives in the Belt."

"Who?"

"Arie Hague."

"Hey! I've heard of him. He's the guy that found that—"

Dykstra cut him off. "Found that mistake in the Dykstra gravity equations. I've been hearing about that for twenty years. The fact that it wasn't a mistake he found doesn't change the perception on the part of the public . . . or my colleagues, for that matter."

"You disagree?"

Dykstra took a deep breath. "No point in letting myself get upset about it all over again," he said. "What Hague found was a discontinuity in the full five dimensional expression of my gravity equations. I knew it was there. I ignored it because it was physically irrelevant. It still seems that way—Hague never has demonstrated any reason why the discontinuity shouldn't just be ignored." His tone lightened. "Still, to have even found it. . . .

"Oh, well, all of this is beside the point. In my judgment, Arie Hague is the one person besides myself who I'm certain understands the physics involved well enough to have invented the Belt antimatter process."

"So, we're going to kidnap Arie Hague?"

"Yes, but what's the justification? Why are you kidnapping him?"

"Hell, that's easy. If he's all you say he is, then just taking him away from the Belt is enough reason. Besides, once he's here, we might be able to bribe or coerce him into working for

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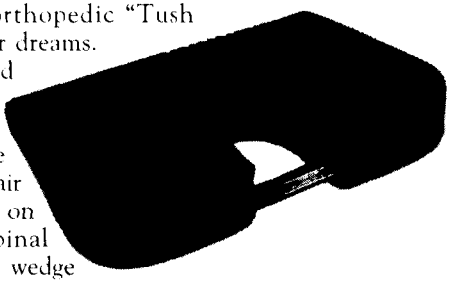

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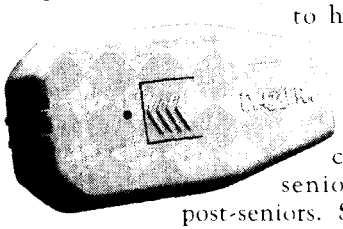

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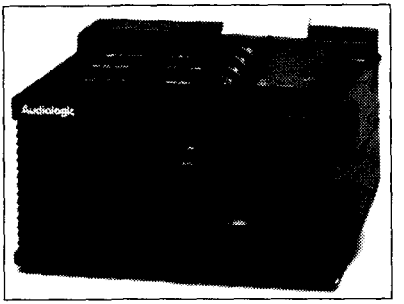

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us. We've already seen what one super genius can do." Nachtegall added, grinning.

"There's one other reason you probably haven't heard about yet. If it's Hague, I think I know what he'll be working on here, provided we can get him to do it."

"What?"

"The alien faster-than-light drive. If it exists, that is."

Nachtegall's eyes went wide. "I *have* heard some things. But most of the other technogeeks, I mean, scientists, don't believe the aliens have one."

"And not without good reason," Dykstra said. "A few months ago I would have agreed that FTL drives are an impossibility."

"And now?"

Dykstra sat solemnly, though still waving his cane unconsciously. "But lately I've seen too many new tricks in my physics. Maybe it can be done. One thing I do know, if the discontinuity Hague rediscovered does have physical significance, then the possibility of FTL travel is assured. That's one reason why I ignored it in the first place."

"Oh, geez, look at the time," Nachtegall said, rising abruptly. "Sorry, Chris, but I gotta get out of here. I have to be somewhere in ten minutes."

Dykstra rose also. "Another meeting?"

"A date," the lieutenant said. "It isn't every day a brave man goes off on a secret mission he may never return from."

Dykstra laughed.

"I guess we figured it all out," Nachtegall said.

"Not all of it," Dykstra said. "What's the psychiatrist for?"

V

The week following the lieutenant's departure brought no direct word on the success of his mission. Dykstra, concerned for the safety of his friend, kept his ear to the ground for any news out of the "spook camp," that subdivision of Patrol Intelligence devoted to using any means possible to gather information on the enemy. He caught excited whispers about a successful Patrol raiding mission. The smug smile on the face of General Hadella confirmed that something had gone very well recently in Special Operations.

Dykstra's professional work moved along. He was handed the task of designing a power system and spacecraft drive centered around his mass conversion technology. In the process he gained a helper and disciple—Rick Vander Kam.

"Any additional news on the lieutenant, Chris?" Dykstra heard immediately upon entering the lab.

"Not yet, Rick. Bob's only been gone a week. But I did overhear General Hadella mention something about a big surprise and good news for the 'alien technology boys.' I assume Nachtegall's return will coincide with the release of that information."

"So Bob will be back in a day or two?"

"I hope so."

Designing *a* power system based

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on mass conversion technology was easy. Designing one that was useful for the military was a different matter. Though Dykstra was both brilliant theorist and experimentalist, he had seldom had to do the sort of intensive detail work that turned a brilliant demonstration experiment into a great product. But that was Vander Kam's *forte*. Dykstra was routinely impressed by the younger scientist's deftness at both finding necessary equipment already on the market, and designing things that would meet their unique needs.

The morning proceeded without unusual incident, but while they were at lunch, general quarters sounded.

"Whoa! Wonder what's up?" Rick exclaimed.

"I'm sure we'll soon know. But let's go to the tracking room," Dykstra said.

The tracking room was a broken anthill of activity, with orders being shouted and relayed, and the data display being continuously updated. The big screen told most of the story, with the chatter providing the sound track.

"One raider. That's all I see!" "I check that." "Velocity 3,026 kilometers per second." "Course?" "Flyover of the North American west coast. I'd say California." "He'll be there in ninety-five seconds." "Still no other tracks?" "Negative. He's running this thing alone."

Dykstra and Vander Kam watched with rapt attention from the railing. Dykstra had not missed the reference to California, but revealed his concern only in a soft, unconscious tapping of his cane against the floor.

"Demon chaser missiles away!" "They won't catch him." "Sure they will—in an hour or so." "Earth's laser batteries will fry him before then." "Maybe."

"Does any of this make sense to you, Chris?" Rick asked.

"My guess is that this is a limited raid with narrow objectives. But I don't know what those might be."

"Uh oh. He's dropped three missiles." "Got it. Twenty seconds to impact. Initial track puts all of them in California." "The raider is blasting off vector. Evasive maneuvers." "He's finished what he came here to do."

Dykstra and Vander Kam were watching the screen when it displayed California and three circles representing the missile impact sites. Dykstra let out a gasp.

"What's the matter, Chris?"

"I'm from California, Rick."

"Are you familiar with the areas hit?"

"Intimately. My home is on the west side of the Sierra Nevadas."

"Near the impact sites?"

"Under them."

They stayed a while longer. The view of California expanded to show the impact areas in detail. The warheads had leveled and incinerated hundreds of square kilometers of lakes and streams, fields and forests, and at least one house—Dykstra's house.

"Dr. James Christian Dykstra, report to Major Moore," came over the P.A.

Dykstra set off with heavy foot-

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steps, leaning greatly on his cane.

Alone in his suite, lights dimmed, Dykstra brooded.

He'd lived in the house one year short of a century. He remembered the parties, the late nights spent talking to the brightest lights of the 21st century—scientific, literary, entertainment. He relived that last chess game with his best friend, Jamie. He shed a tear over the image of Jennifer, saying good-bye to him from her deathbed.

His collection of chess sets was gone forever, all 300. His music collection now just random atoms.

Priceless works of art, gifts from admirers and friends, now just vapor.

Their monetary value was meaningless. Their sentimental value, incalculable.

But what he most regretted losing were the letters—hundreds of letters written to him over a period of seven decades—from Jennifer.

They'd been together since before the Collapse. She'd loved him. It was a love he couldn't return, not the way she wanted.

Their souls had been linked. Jennifer had told him he'd been placed on the Earth for a purpose, and that she had been placed there to be beside him, and that's all that mattered.

Her letters had been a comfort whenever she was away. After her death, he'd often pulled them out just to look at them, and relive precious moments.

Gone. All gone.

He cried.

* * *

Dykstra was awake by four in the morning. He didn't get up, though. He felt old. He rolled over and pulled the pillow under his face. Too warm, he pushed the covers away. Too cold, he drew them back.

Nothing helped—he was just a tired old man, unable to sleep.

Images still played through his mind, as they had earlier—scenes from the tracking room, the meeting with Moore, and even of himself, crying pathetically.

He slipped away again.

He was jolted awake by the door buzzer.

"Huh? What? Oh, good Lord, Richard Michaels was coming this morning." The clock said 8:01. Despite the turmoil of the previous day, he kept the man waiting only an additional two minutes.

"Enter," Dykstra said as he left the bedroom.

The door slid open and a boyish young man entered, and stumbled, but caught himself before going over altogether. "Oh, I'm sorry, Mr. Michaels. The gravity is half standard in my rooms. I should have warned you."

"That's all right," Michaels said, gathering his composure. "I've been through a lot worse recently."

"Where have they been keeping you, Mr. Michaels?" Dykstra asked.

"I've been down Earthside, visiting VIPs at the regional capitals. They all want to hear about the aliens firsthand."

"I see," Dykstra said. "I wanted to meet with you because I need to understand the aliens better. Some as-

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pects of their technology mystify me. Perhaps you can give me some insights into their personalities."

"I'll do my best," Michaels said.

"But first, one of the things we've been doing is trying to determine whether or not the aliens have FTL travel—"

"They must," Michaels interrupted. "First there wasn't anything on the scanners, including the Dykdar, and then there was. The ship just popped in out of nowhere. What else could it be?"

"It could be FTL, true. But it could also be advanced stealth technology, even against Dykstra wave scanning."

"I thought that was impossible."

"I've seen enough 'impossible' things in the past month to make me leery of that word. But apart from stealth, they might also have come in at very near to light speed, say 99.9 percent, then done the equivalent of a quantum transition to a lower velocity state. It would look much the same as a magical transition from FTL to sublight."

"Quantum velocity states?" Michaels looked bewildered.

"A speculative technology that didn't pan out in the details. But the point is, there are lots of possibilities to explain what you say that don't require FTL drive. Unfortunately, your memory is the only record we have of that event—we never could get the data out of your ship's log."

"Tell me, Dr. Dykstra, do you think they really have FTL drive, or will it be one of the less exciting possibilities?"

"Before I answer, first tell me if you're familiar with the work of Marie Hague."

"Hague? Isn't he the one who rediscovered the discontinuity in the full expression of your gravity equations?"

Dykstra laughed at the young man's diplomacy. "You phrased that *just* right. Well, for our Sun, the gravity equations theoretically break down on a shell roughly 57.4 astronomical units in radius. It's called the Hague Limit. I've always believed that the limit has no physical meaning, mainly because it implies the possibility of FTL travel and thus the usual causality paradoxes.

"So to answer your question, if the aliens do have FTL travel, then Hague is right and I was wrong to ignore the discontinuity. For reasons of professional pride, I'd like to say that I don't believe in an alien FTL drive."

"I sense a 'but' in there," Michaels said.

"*But* . . ." Dykstra said, "to use an expression one of my old friends was fond of, FTL travel would be 'nifty as tits.' "

They both laughed. "So . . ." Michaels finally said, "your bottom line is that you just don't know."

"Correct. However, I am sure of one thing, and I don't know if even Hague has figured this out yet. But if the aliens do have FTL drive, then they can't use it inside the Hague limit. The physics of why that must be so is a little hairy, but I'm certain of it."

Dykstra asked Michaels what he wanted to drink, then discovered the man hadn't had breakfast, and set the

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autochef to preparing a suitable repast. After a swig of orange juice to wash down his last bit of toast, Dykstra said, "But how did you *feel* when you first encountered the aliens. I mean, what was your impression of them, apart from the situation?"

"I happen to be one of those people who can't abide spiders. Ants, beetles, other bugs don't bother me," Michaels said. "But spiders . . . I think Satan himself invented spiders."

Dykstra listened. His pet tarantula must be crispy critters now, but he didn't mention it. Michaels obviously hadn't been told of his recent loss.

Michaels continued. "After the aliens blasted their way in, I got a good look at them when they came into the corridor. The backwards bending elbows and knees were funky enough, but what struck me wasn't the way they looked. It was that I felt like I was up against big spiders, things that were so utterly different. . . ." He trailed off.

"You're stuck because the best way you can describe the aliens is as 'otherworldly,' and that's a bit redundant," Dykstra said.

"Right. I mean, put me in a corral with a horse, or a cow, or even in a zoo with an elephant, and there's still this sense of common ground. I can empathize with an animal. Even dolphins, and they come from an entirely different environment.

"But the aliens were like spiders—who can empathize with a spider? They walked on two feet, they had technology, they flew spaceships. But as they stalked my ship, when I was killing that one, even when the other one ran away like a bat out of hell, it just didn't feel like humans have anything in common with them at all.

"I know this is subjective—"

"That's all right," Dykstra said. "I'm finding this very valuable. There are aspects to their technology that made me feel much the same way that you're describing."

Michaels sat quietly for a minute, just staring at the wall. "Dr. Dykstra, you're a religious man, right? I seem to remember something from your biography about you and the Calvinist Reformed Church."

More memories flooded Dykstra's mind, most pleasant, some unwelcome. Whole chapters of his life had been devoted to that church. The story of his life made a very long book. "Yes, I'm a religious man."

"I'm not," Michaels said. "I'm a lazy agnostic. I was always just live and let live on the subject."

"Have the aliens affected your thinking?" Dykstra asked.

"Maybe. Because the best way I can think of to describe them involves a religious idea."

"That being?"

"The soul, Dr. Dykstra. I'm not much of a philosopher or theologian, but as the only man who's actually met the aliens face to face, I think I have a right to an opinion. And I don't think the aliens have souls."

VI

Nachtegall's left hand was bandaged, and tubes ran into the dressing from a portable med unit strapped around his arm. "What happened to

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your hand?" Dykstra asked. The lieutenant, sitting on Dykstra's couch, had gotten in late yesterday.

"The original is somewhere in the Belt. This one," he raised the globe of bandage, "is a cloned replacement they attached last night. I'll be good as new in a few days."

"How did you lose it?"

"Getting Hague out of that dungeon they had him in. All right, so it wasn't a dungeon, but I don't think he could come and go as he pleased." Nachtegall got a strange look on his face. "Not that he would ever want to. Have you met him yet?"

"Major Moore said Hague would be in my lab early this afternoon. The med teams aren't finished with him yet." Then: "It was rough, wasn't it?"

Nachtegall's shoulders sank. He cradled his new hand in his lap. "Yeah, Chris. It was rough. We lost almost everybody. That's all I can tell you. But if Hague really is their best brain, they'll be readying some kind of retaliation. And they're going to be pissed about that laboratory station."

Dykstra gave Nachtegall a sardonic smile. "They've already retaliated," he said. "*Lex talionis.* A few days ago they hit California with fusion bombs. My house was under them."

"What?"

"They don't know I'm on the Moon, I guess. We deprived them of their mad scientist. They wanted to deprive us of ours."

"I'm sorry, Chris. You loved that place."

Dykstra stood up. "There's a war on. We don't have time for sentimentality. Now, tell me about Hague."

Nachtegall frowned. "Moore won't let me. He was specific."

"Oh?"

Dykstra arrived at his lab to find Vander Kam already there with Major Moore and another man. He assumed it was Hague, but he'd never seen any picture of the man. Judging by the man's appearance, he now knew why.

"Dr. Dykstra," Moore said. "I'd like you to meet your new colleague, Dr. Arie Hague. Dr. Hague, this is Dr. James Christian Dykstra."

"Pleased to meet you," Dykstra said, extending his hand.

Hague took Dykstra's hand limply. "Yes, Dr. Dykstra, Dr. Dykstra, yes, yes, Dr. Dykstra." Hague was short and chubby, with soft muscles and a pinched face surrounding an undersized, pointy nose. "Yes, wonderful lab, wonderful lab, Dr. Dykstra, yes." He was nodding his head and smiling, and seemed to have forgotten that he was still clasping Dykstra's hand.

Dykstra looked him over. So this was his rival, the man responsible for the only controversy to arise from his work. *An autistic savant. Incredibly deep talents, but so narrowly focused. Now I know how he could plunge so far into my physics, and still remain so unknown outside the discipline. They kept him under wraps.* "Have you shown Dr. Hague our facilities yet, Rick?"

"Just briefly," Vander Kam said. "He'd really like to look over our mass converter, I think." Vander Kam had already referred to Hague in the third person, as if he weren't there. Hague didn't notice.

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Dykstra disengaged his hand. "Shall we have a look at our current project, Dr. Hague?" he said, leading the squat prodigy over to the table on which the gear was spread.

Major Moore waved from the door and made his exit, smiling, as if pleased with himself.

"Oh yes, Dr. Dykstra. The equipment, the experiment, yes, the work. Let us examine the work, Dr. Dykstra, yes."

Dykstra explained the theoretical details of the mass conversion process, and Vander Kam covered specific items dealing with the device itself. Hague was a good listener except for his maddening habit of muttering, "Yes, oh yes, Dr. Dykstra, very good, yes," after every other sentence.

It was when Vander Kam was discussing the specifics of the power control unit that Hague showed the first real glimpse of his uncanny talent. "Not right, no, not right, Dr. Vander Kam, no. Not right. Not good. Not this one."

"Why?" Dykstra asked. "What's wrong with that power control?"

"Not right. Not best," Hague said. "Magnoflux Electrics Catalog, page 453, entry five, model SQG-100230983-A. Need that one. Yes, need that one, is best, yes, need that one."

Vander Kam looked at Dykstra, shrugged, and called up the entry from the catalog. Dykstra looked at the screen, read the specs, turned to Vander Kam and said, "He's right."

Vander Kam nodded assent. "I know. Damn! I looked through catalogs for three hours just trying to find the one we've got now."

Hague was still at the table. While the other two had been distracted, he'd decided to fiddle with the device. "Hey!" Vander Kam shouted as Hague pulled out a field guide.

"Wrong shape, wrong, all wrong. More curve, yes, curve. Radius of curvature 4.55982 centimeters, 4.55982 needed."

Vander Kam rushed to the table and took the field guide away, then turned to Dykstra and looked at him helplessly.

Hague was jumping up at Vander Kam's hand, trying to retrieve the piece. "Give back, let me fix. I can fix. Please, I can fix, yes, I can fix. 4.55982 centimeters, yes."

"Give it back to him, Rick. Let's see what our new colleague can do." As he said it, he felt the sudden onset of a chill, as if the Sun had gone into eclipse.

"Dr. Dykstra?" Moore's face filled the screen. Dykstra was in bed, but the red blinking light by the screen had indicated an urgent priority, so he accepted the call.

"Yes, Major Moore? What is it?"

"I'm sorry to wake you, Doctor. But there's a new file on the system tonight, SLINGSHOT. Look at it immediately. You'll understand what's involved from the technical end and I think you'll want to start dealing with this new information right away."

"Oh, c'mon Major, give me just a little hint," Dykstra said.

Moore frowned, looked serious, and said, "The aliens have made another appearance. We learned some

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new things from this encounter. You of all people should look into it right away." Then with an expression Dykstra could best describe as "savage delight," Moore added, "And Dr. Hague, too." He broke off the connection.

Dragging himself from bed, Dykstra instructed the autochef to make him coffee, lightened to a 50 percent concentration of cream, and brought up his workstation. He retrieved the SLINGSHOT file.

Reading rapidly, he discovered the basic facts. Slingshot was the code name for a System Patrol base some sixty astronomical units out. The work there involved investigating methods of delivery for kinetic kill projectiles against Dykstra shielded installations. Dykstra knew better than anyone that the best way to crack a shield was to smack it with something heavy moving fast. Most of the work involved the use of close orbits past airless moons and asteroids by warheads that were essentially rocks equipped with high gradient pseudograv generators. The rocks were to be introduced into the Belt along carefully determined trajectories, where they'd perform close flybys of asteroids to undetectably pick up speed and alter their vectors, then smash into, as the text put it, "Belt military assets."

Dykstra admired the work, recognizing some of it as brilliant; he'd have to check out the Slingshot base roster to see who was responsible.

Details were sketchy, and more information was promised for later, but the base had been hit by two alien spacecraft. They'd come in fast, without warning, and opened fire. The base had taken a beating, but somehow they'd managed to wreck one of the alien ships, and the other had immediately raced away.

OK, this is all very interesting, but why couldn't it have waited until morning?

He found a cache of raw data from the tracking instruments that had first acquired the incoming alien ships. There was no visual data yet. The base was a wreck. The only information Intelligence had as yet was the text of the messages the acting base commander had sent, and whatever raw instrument data that was in shape to transmit.

It took Dykstra only moments to orient himself to the numbers in the data cache. Here were the readings from the spatial position where the alien ships would shortly appear. There: Doppler radar and Dykdar scans indicating two craft, two hundred thousand kilometers out, closing rapidly. The tracking data followed the two vessels up until the moment they destroyed the scanning instruments.

What he saw disturbed him.

"OK," he muttered. "Let's take a closer look at the time sequence." Time was resolved to the millisecond. At 14:31:46.003 the scans showed nothing. At 14:31:46.004, indications of one object appeared. At 14:31:46.013, a second object appeared, while the first was now a clear image.

But the scanning radius for the Dykdar alone was over five million ki-

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lometers. Even incoming at almost light speed would have put the ships in the Dykdar scan volume for sixteen seconds prior to their emergence.

But one moment, nothing, one hundredth of a second later, two ships, and both only two hundred thousand klicks out.

"Dear Lord!" Dykstra exclaimed. "They have it. Faster-than-light drive. Hyperdrive, overdrive, ultradrive, warp drive, and everything else the science fiction people have named it. The aliens have it."

But how does it work? I have no idea how it works. It was clear why Moore had called. The major was right; Dykstra was glad to have this information immediately. But something else: Major Moore knew it would not be wasted on Dykstra that Hague had been right about the discontinuity. And he, wrong. *Spite, Major? Was your call motivated out of spite?*

No point in being small about it. His second call found Hague in the lab. "Yes, oh yes, Dr. Dykstra, oh yes?" Dykstra told his colleague the news. "Yes, *oh yes*, Dr. Dykstra, *oh yes*!"

Since the confirmation of the aliens' FTL capability, Dykstra had thrown himself at the problem of understanding how it must work. The past week and a half had found him sequestered in his apartment, chained to his work station, reverting to his old form of working alone.

He tried to keep Hague apprised. Now and then he'd call the lab where Hague was continuing the work, with great success, on the mass convertor, and discuss various theoretical approaches.

"Ah, yes, yes, Dr. Dykstra, yes, I'll think about that, yes, oh yes," was the typical reply. Once Hague returned a call and reeled off a long string of mathematical expressions. Dykstra was almost certain Hague had made a mistake.

Almost.

He'd torn apart his own preconceptions, reconstructed his gravity theory all over again, tracked down ingenious, esoteric, and sometimes goofy ideas in the literature, and tried to synthesize the possibilities into one rigorous whole.

He was still trying when someone showed up at his door. A glance at the clock showed it to be 1930 hours. "Come in," Dykstra said, arising stiffly from his chair. He twisted his neck to work out a kink.

Major Moore entered, uttered preliminary niceties, and got down to business. "This Samantha MacTavish you wanted me to recruit, Doctor—"

"The genano engineer. Have you talked to her?"

"Yes. You're right—she's something special. She's also a tough nut to crack. She doesn't like the military one damn bit."

"A pacifist?"

"It has more to do with her husband being drafted shortly after their marriage."

"I see."

"And I was indirectly responsible for her husband's draft notice. He's an astrophysicist. He was also the best suicide orbiteer on Luna."

"Ah, yes," Dykstra said. "Those fel-

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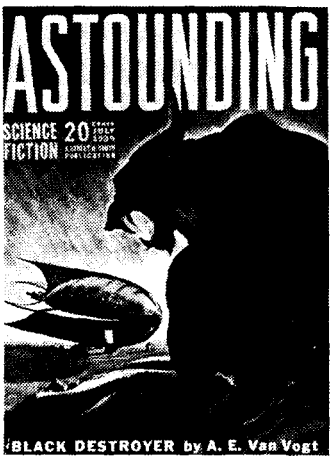

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lows who plot close approach trajectories to the surface and then follow them in space suits. A wild hobby." Something occurred to Dykstra. "Close approach orbits, hmm? Did he wind up at Slingshot?"

"That's where we put him. Samantha thinks he's on a battleship," Moore said. "And she'd better not find out different from you."

"How's that, Major?"

Moore frowned. "Let me lay it on the line, Dr. Dykstra. I've been bending over backwards trying to land this woman for us. If it were up to me, I would have given up long ago. But my superiors, because *you* requested her, want me to play the persistent suitor. To do that, I've had to let her in on the existence of the aliens, but she is not cleared for anything else, and that includes where we put her husband—"

"How is he, by the way?" Dykstra interrupted. Moore was getting wound up, and Dykstra didn't like it.

"What? Oh yeah, the base. He's probably fine. We don't have a casualty list yet, but I'd guess most of the fatalities came along the regulars. Ensign MacTavish would have been buttoned up deep inside during the raid, or else zipped away in a lifeboat. Why?"

"Just curious," Dykstra said innocently, but he'd derailed the major's train of thought.

"Right. Well . . . Ms. MacTavish is going to visit you tomorrow, and you're supposed to convince her of the merits of joining us in our work. She's visiting Richard Michaels in the morning, and she'll be over here after lunch."

"But I wasn't informed—" Dykstra began to protest.

"I'm informing you now," Moore said, regaining the initiative. "You wanted her, you can help us get her. I'd suggest you look in her file before tomorrow. Good evening, Doctor." He turned abruptly and strode out.

"OK," Dykstra said to his back.

After the encounter with Moore's obvious hostility, Dykstra found it impossible to return to work. He got dinner; he'd forgotten to eat earlier. Lt. Nachtegall came by at 2100 and woke Dykstra up as he dozed listening to music.

Over coffee, Dykstra asked the lieutenant what the major's problem was.

"Major Moore would slice me open from throat to groin and pour in hot coals if he knew I'd told you this. The major didn't want you here. He fought bringing you in right up until he was formally ordered to try."

"But why? Doesn't he think I'm capable? I think I've proved myself," Dykstra said.

"You have. Beyond anyone's wildest dreams. But that only makes it worse. You see, the major is responsible for the scientific personnel here, a whole bunch of guys who are a hell of a lot brighter than he is. Moore is no dummy, even though he was just a peacetime bureaucrat officer, but he knows he doesn't have the brains to go toe to toe with any of the people under him. But he does have authority over them, and he can push them around, and he can always get rid of someone because there're

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more young geniuses out there to pick from.

"But you're James Christian Dykstra. You're the best. Who can he replace you with? He wanted you to fall flat on your face when you came here. You didn't. He knows there isn't a damn thing he can do about you if you decide to have things your own way, and he doesn't like it."

"Like with Samantha?"

"Yeah. She's a babe-and-a-half, by the way. I met her when I dropped off the data on the alien at her apartment. Anyway, he was sick of trying to lure her in to work for Intelligence, but there you are, you wanted her, and what the Genius wants, the Genius gets."

"But I haven't been unreasonable, have I?"

"No. But you *could* be if you wanted to. Major Moore is a military man. He looks at capabilities, not intentions."

"I assume then that he'd like to have a way to neutralize my supposed advantage. And that explains—" Dykstra began.

"Hague," Nachtegall said. "If Hague works out here—"

"He is working out," Dykstra said.

"Right. If Hague works out, then Moore can look for excuses to send you home. And Hague isn't likely to give him any trouble."

After Nachtegall left, Dykstra called up Samatha MacTavish's file. There were academic records and comments from instructors, some even reaching back to elementary school. *I'll say one thing for Moore—he's thorough.*

In the personal section he saw that she preferred to be addressed as Ms. MacTavish rather than Dr. MacTavish, even though she'd earned her Ph.D. She also most often went by "Sammi," but some close friends called here "Sunshine." He looked at her picture, noted the dancing eyes and the shining smile, and understood the nickname.

There was also an extensive section concerning Moore's own personal observations of the candidate, which ranged from neutral to overtly hostile. *He could have limited my access to this stuff. He wanted me to see it.*

The rest of the document contained the evidence of what Dykstra already knew—that Samantha MacTavish was a rare genius indeed.

Closing her file, on a whim, he opened another. *Just what kind of a man would have been confident enough to marry a supernova like you,* he thought. He looked into the Slingshot files under Ensign MacTavish, Steven J. All he found there was a note referring to another file, that of Ensign Smith, Steven J. Samantha's husband had taken her maiden name as his own. There was no explanation why, though Dykstra guessed that perhaps Steve had wanted a name less common than "Smith." At any rate, it revealed a secure man.

The rest of the document revealed much more.

Steve was the solar champion suicide orbiteer, having once taken a plunge that zipped him past the lunar surface close enough to leave a mark. Here was the man responsible for the

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brilliant work Dykstra had noticed in the SLINGSHOT file. *I see you married an equal, Samantha. I'm impressed.*

Lt. Nachtegall arrived at Samantha MacTavish's door at exactly 1000 Saturday morning. He recalled their first meeting. She'd been cold and wouldn't even invite him in. Too bad, too. She was something to look at.

The door opened. Samantha was stylishly dressed, wearing a loose blouse and mid-thigh skirt. Nachtegall took in the pleasing curves of her body without once letting his eyes drop from her face. "Hello, Lieutenant." She smiled, a sunrise on a frosty morning. "You're right on time."

"Major Moore insists on it," he said. He led her up topside to the landing berths and they set out across Mare Crisium in the military courier boat. There wasn't a hint of her earlier hostility, though she seemed edgy, drumming her fingers on the armrest.

"Are you nervous, Ms. MacTavish?"

"Yes I am," she said without hesitation. "Have you ever met Dr. Dykstra?"

"Yes."

"What's he like? I mean, does he *seem* like a legend when you're with him?"

"So that's it," Nachtegall laughed. "You have nothing to worry about. His genius does live up to its legendary billing, but when you're with him you'll just think he's a sweet old man."

Nachtegall's words settled her. After a bit she said, "Lieutenant, can I ask you a question?"

"Call me Bob, please, Ms. MacTavish."

"OK. Call me Samantha."

"Done. And yes, you can ask me a question if I get to have one in return."

"Fair enough. I don't know quite how to ask this, but . . . did you think I was a bitch that first time you stopped by?"

Yes I did, Nachtegall thought. "I thought you were rather cold, Samantha. But I didn't take it personally. Major Moore had warned me that you weren't fond of the military."

"I'm not. But that doesn't excuse my behavior. I'm sorry I didn't even let you in the door."

"Apology accepted," Nachtegall said. "Now my question: Why don't you like to be called 'Doctor'?"

"It makes me feel *old.*"

"That's it?"

"Lieutenant, do I *look* like a Dr. MacTavish?"

They landed at the High Command and the lieutenant led Samantha through the labyrinth.

He left her alone in an office, but waited outside the door for Moore. Moore arrived and went in to talk with Samantha, emerging soon thereafter with a disgusted look on his face. Richard Michaels came, and Nachtegall was directed to wait outside until Michaels and MacTavish were finished.

"Goddamn guard duty," Nachtegall muttered. He dozed in a chair until his subconscious notified him that an hour had passed and it was time to take Samantha to lunch.

"So what did you think of Richard Michaels?" Nachtegall asked Saman-

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tha as they sat eating.

"He's a nice guy," she said. "Haunted, though. I guess being forced to kill will do that to a person. And considering what the first thing was he killed. . . ."

"Yeah. That'll sober a guy up."

They went to Dykstra's apartment. Samantha was nervous again. Nachtegall felt sorry for leaving her there at the door. But she'd be OK—Chris would take good care of her.

After an hour he returned for her. If the Sunshine he'd left at the door had suffered from cloudy skies, the girl he flew back to her room was as bright as a crisp, clear, Rocky Mountain afternoon.

"Oh, Bob! He was everything you said he was, and more. He was so kind, and down to earth, and *brilliant!* And there I was, talking to the legend, and . . . and . . ."

"Holding your own?"

"*Yes!* He treated me like an equal. And I think he liked me, apart from my abilities, I think he liked me as a person." Her smile lit the interior of the shuttle, and dispelled the shadows outside.

"I get the picture," Nachtegall said. Dykstra was something else. Even at his age, he could still charm the young ladies. The lieutenant wished Samantha would gush about him that way.

Later, Nachtegall reported to Moore the bare details of Samantha's visit. The major wasn't interested in hearing more. Then he went to Dykstra's to see what the old professor's view was of Sunshine.

"What a thoroughly *delightful* woman," Dykstra said. "And what an appropriate nickname. 'Sunshine'—it's obvious how she got it."

"She was thoroughly impressed with you too, Chris. She gushed all the way back to Luna City, pleased as hell that you treated her like an equal."

"She deserves that kind of respect. She has the gift, or the spark, call it what you will. She's equal to or better than any of the others Moore has gathered here. But I couldn't convince her to join us yet. I hope she decides in our favor. She could add a dimension to our work that we haven't even touched yet."

Nachtegall sensed *déjà vu.* Hadn't he heard this sort of bewitched infatuation earlier today? "You feel more than just respect for her intelligence, don't you, Chris?"

"Is it that obvious?" Nachtegall nodded. "She reminds me of someone, Bob. Someone who was very special to me. Jennifer didn't look anything like Samantha, but somehow I think they shared the same spirit," Dykstra smiled faintly, wistfully.

Jealousy nipped at Nachtegall's heart. "You're not in danger of falling in love with her, are you?"

"What?" Dykstra laughed. "Are you worried about *my* heart, lieutenant? Or is it your own that you should be minding?" Dykstra's look went in ten centimeters deep.

"She does have that effect on men, doesn't she?"

"She's a married woman," Dykstra said.

"And you're five times her age," Nachtegall said.

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"There's no reason to bring *that* up."

VIII

Sunday morning Dykstra went to chapel. The sermon was old hat. His mind wandered. While Chaplain Townsend preached about the calling of Abram, Dykstra wondered about the place of the Phinons—the project name was now almost a synonym for the aliens—in the cosmological order, particularly if they were intelligent yet lacked souls.

He got nowhere, but at least the sermon ended before his snores became audible.

Feeling renewed both from the morning service and yesterday's visit by Samantha, he sat at his workstation filled with exceptional vigor, eager to again dive into his theoretical work on the Phinon FTL drive. It proved frustrating. Almost he was there. But some pieces were missing.

They were still missing on Monday.

Tuesday he went to the lab. "Yes, yes, Dr. Dykstra, welcome, yes, yes. You must see the mass convertor now, yes, oh yes. It works so much better now, yes."

"Dr. Hague isn't kidding," Vander Kam said. "We just measured our conversion efficiency at over 95 percent."

"That's incredible! The Phinons's own device was only at 92 percent," Dykstra exclaimed. "How did you do it?"

"It was all Dr. Hague. I hate to admit it, but he pretty much just told me what to do. The result is over there." He gestured toward the machine where Hague was lovingly going over the instruments. "We think this model is the one we'll scale up to half size. Of course, we'll have to relocate to Farside Station."

"Oh? When?" Dykstra asked, surprised. His project was slipping—no, had slipped—away from him.

"I've talked to Major Moore. We'll probably be leaving within the month. The facilities in Paracelsus crater should serve. That's where the antimatter power plants are tested. But when we leave depends on when that alien drive unit gets here. Moore wants Hague to see it."

Since the Phinon attack on Slingshot, information about the raid had come out slowly, but regularly. The wrecked alien vessel had been done in when a lifeboat rammed it. Dykstra found that appropriate since Slingshot had existed to find novel ways to use kinetic kill methods against Dykstra shields. The lifeboat had rammed in just the right way to cause the shield to collapse catastrophically over the front section of the alien ship. Dykstra wondered if the pilot had planned it that way. The drive section, and the FTL engine, were left intact, and these were now on their way to Luna.

"What did he think about the other alien artifacts?"

"He hasn't seen any yet," Vander Kam replied. "You solved the intractable technological problems, and I think all those items are with the anthropo and socio and psycho types. Probably the artists, too."

"Tell me, Rick—what's it like to work with Hague day after day?"

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"He's not much for conversation. He drives me nuts with his speech mannerisms. And heaven forbid the routine gets changed—"

"The autistic typically require the routine and familiar," Dykstra said.

"But what can I say? He looks at something, says it isn't right, we make some changes, and they're always an improvement. It's amazing."

"He's better at this sort of thing than I am," Dykstra sighed, watching the diminutive scientist scurrying about.

"I don't know about that."

"Oh, bosh! You just told me he does things that I know I can't do," Dykstra retorted.

"You invented modern physics, Chris."

"That was a long time ago. When I was young."

"Oh, c'mon, Chris," Vander Kam said. "You duplicated the aliens' mass conversion method. No one else was able to do that. Only you could do it."

"I'm not so sure," he shrugged. "I've been working with Dykstra fields for over a century. So along comes an alien device that does a new trick. I didn't think up how to do the trick. I only figured it out once I knew it could be done and had an example in front of me." He raised his cane and pointed it in the direction of Hague, who turned and smiled, said "yes, yes," and went back to work. "And it took another man to make the device practical."

"You're not being fair to yourself, Chris. You've been working on FTL drive studies. You could have improved it yourself if you'd been here."

"Not to 95 percent, Rick. Not in two weeks. Not at my age."

Wednesday morning Dykstra took the fast elevator up to the small observation bubble on the top of the High Command mountain. To the north he could see the crags and rugged undulations of highland topography. To the south, the bare plain of Mare Crisium, broken by myriads of small craters, spreading away to the horizon.

Sharp shadows carved the landscape.

Dykstra looked up at the stars, bright, keen, sparkling beacons outlining the road to destiny.

He'd decided this morning that he'd gotten as far as he was going to with the FTL theory until he could look inside that engine. *It's cheating,* he thought. *But I'm an old man.*

He relived his hour with Samantha MacTavish—Sunshine. She was so quick, so bright, so young. So like Jennifer. The future belonged to such as she. It would be the Sunshines of the world who would travel the road to the stars.

Dykstra descended. Emerging from the elevator, Major Moore plowed into him.

"I'm sorry, Dr. Dykstra. Excuse me. I wasn't watching where I was going." He seemed jovial.

"Quite all right, Major. Say, has Ms. MacTavish agreed to join us yet?"

Dykstra thought Moore's smile broadened a hint.

"No, Doctor. It turns out that her husband *did* die in the alien attack.

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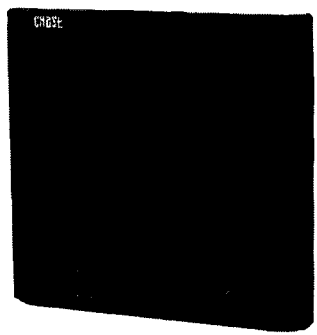

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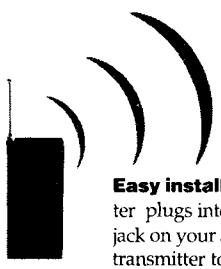

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She didn't take the news too well. She went ballistic; threw the notifying officer right out of her apartment. She was down on the military before—you can imagine how she feels now."

Dykstra felt a dull burning inside, wrapped around hollowness. He'd lost many himself—he knew what she was going through. "When did you find out?"

"Yesterday."

"And you didn't tell me?"

Moore's expression hardened. "Obviously not, Doctor. You have no official interest in this matter."

The major was right, but Dykstra hated the petty delight Moore was taking in spelling that out to him now.

Moore lightened up. "Lt. Nachtegall did inform me that you and Ms. MacTavish 'hit it off' as he put it. I suppose you'll want to go to the funeral. It's tomorrow morning."

"Thanks for telling me."

"Not at all. But Samantha still doesn't know how or where her husband died. Perhaps after the war we can tell her. Right now we can't risk letting the Belt know about either the aliens or Slingshot. You mustn't discuss those subjects."

Dykstra didn't like it. "Major, I must protest. She already knows about the aliens, and Slingshot is moot now. She has a right to know how her husband died. She has a right to know how his last minutes were lived."

"Bullshit, Doctor. Bullshit! Even if I grant the existence of such a sentimental right, I'm damn sure that it is neither your duty nor your right to tell her. Do I make myself clear?"

"Clearer than you know, Major," Dykstra sighed.

"I'm sorry for leaning on you, Doctor. But security is important to me. Go ahead, take tomorrow off, go to the funeral if you wish, or just enjoy what Luna City has to offer." Moore chuckled lightly and patted him on the back.

The insincerity was galling. Dykstra said nothing, and set out slowly down the hall. He hated needing the cane.

He went to the funeral. Nachtegall flew him into Luna City and led him to the church, but the lieutenant had other official business and so regretfully had to leave Dykstra there by himself.

From the back, he could see Samantha, in black, shuddering, crying. The minister went on at length about Steve, most of it generic kind words, of giving up his life for some greater, though unspecified, good.

His eyes were drawn to the cross of black lunar glass, Spartan, but dignified in its simplicity. It would stand with thousands of others out in the military cemetery in the Sea of Tranquility.

There was no body to bury.

Samantha slipped out quickly after the ceremony. He had no chance to speak to her, even to let her know he was there, though he thought she may have seen him once.

Friday afternoon Moore called.

"I was wondering how your work is going, Dr. Dykstra. I notice you haven't filed any progress reports in—boy, it looks like over two weeks now."

"I haven't had much to report, Ma-

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jor. I'm temporarily stalled."

"I see. Do you suppose—"

Dykstra didn't let him finish. "I do not yet understand how their drive works. Everything I try leads to contradictions or singularities or discontinuities. And sometimes just plain stupid results."

"You're quitting, Dr. Dykstra? Is that what you mean?" He sounded hopeful.

"No, Major. I'm waiting until the drive unit comes in. I'm hoping it will provide the missing puzzle pieces. In the meantime, I'll see what other project I can help out on."

"Hmmm," Moore said. "It's not as simple as that, Doctor. The other work is all going quite well, much of it because of your success with the alien weapon. But . . . well, to be blunt, the other scientists would not welcome having you on their teams. You know, professional jealousy. And fear that you'll outshine them."

"So I'm just supposed to twiddle my old thumbs until the drive unit arrives?"

"Actually, Dr. Hague will do the studies on the drive. He's quite remarkable with technology, isn't he, Doctor?"

You're not shutting me out, Major! "In that case, I'll continue my theoretical studies. I thought it would be best to set them aside for a while and do something else, but it looks like that won't be practical."

Moore pasted on an empty smile and said, "OK, Dr. Dykstra. But don't get discouraged. I'm sure you'll come up with something."

"Thank you, Major."

"But I need to see progress reports."

For each of the next eight days Moore received an impenetrably math-laden report he could never hope to understand. Finally, he rebelled.

"Doctor, as far as I can tell, you've accomplished nothing except sharply defining your ignorance."

"I told you a week ago I was stalled, Major." Dykstra was sitting on his couch. The major had refused a seat.

"Let's cut the bullshit. You're going to be on the next boat home if you don't justify your worth to this organization. I can't afford to have prima donna geniuses flouting my authority, particularly when they aren't needed anymore."

"Now wait one minute, Major—"

"No! *You* wait," Moore said angrily. "No one has probably ever said this to the Great Genius Dykstra, but I will. We don't need you, Doctor. You've done good work for us, certainly, but we have Hague now, and he can carry the same load. Besides that, he doesn't threaten to go over my head to get his way."

"When did I ever do that?"

"When you forced me to go after MacTavish, Doctor. Or had you forgotten?"

No, he hadn't forgotten the conversation. But it was clear to Dykstra now that when he'd said he could get more funding, Moore had only heard the part about going to the superiors.

The major continued to fume and sputter, finally saying, "Should we send you home, Doctor?"

"I no longer have a home, Major!"

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Moore left, hot as hell, but not yet ready to fire the foremost genius of the age.

Sunday, the men arrived from Slingshot with the alien drive.

IX

A corner of the huge docking bay had been converted into a laboratory for work on the drive section. Dykstra had watched as the tail of the half crushed alien ship was maneuvered into the lab from the bay proper.

It had taken the Patrol a month to bring it in from Slingshot, a month spent in near total communication silence lest the Belt discover them.

A month in which he'd been unable to understand how it worked.

Now he stood before it, alone.

They'd cut open the hull to expose the engine; four meters long, three across at the widest, looking like a tin can that had been crumpled and stretched back out.

Dykstra was not allowed to touch it.

Arie Hague would be along soon; he and Vander Kam were enroute from Paracelsus crater where they'd been looking over the facilities. Major Moore had not specifically forbidden Dykstra to work on the engine, but he'd made it clear that Hague would be in charge of studying the thing, so it would only be proper courtesy that the "other genius" of The Phinon Project get to open it up first.

Of course, putting the pliable Hague in charge meant that Moore would call all the shots.

And take the credit.

"You've foiled me, fiendish engine of alien sorcery," Dykstra said. Perhaps it was best that he couldn't open up the drive unit himself. Yes . . . it would be better to let someone else work on it. *Someone who can get along without a cane,* he thought, as he tapped it against the hull of the ship.

"Hey! I hauled that sucker nine billion kilometers to get it here. Why are you hitting it with that stick?"

Dykstra turned to see a black man in his seventies, wearing coveralls, coming from the doorway. Despite what the man had just said, he looked amused.

"This thing has caused me a month of sleepless nights," Dykstra said. "Just be glad I'm only giving it love taps. By the way, I'm James Christian Dykstra."

"As if I didn't know. I'm Roger Tykes. People call me 'Pops.' "

"You look older than the average Patrol officer," Dykstra noted.

"Hah! As if you should talk, Doctor."

Dykstra liked him. "Please. Call me Chris."

"I am older, Chris. But piloting spaceships is what I like to do. Anyway, I'm too old for the front lines, so I was stationed at Slingshot. That's why my crew and I were the ones who brought that baby in," Pops said.

Dykstra lit up. "You were at the base when the aliens attacked? I know most of the story, but the details were hazy on how we got the drive section. Something about a lifeboat crashing into one of the attacking ships."

Pops became solemn. "Chris," he said, "you find the real heroes among

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the damndest people. It was one of the scientists who did it . . . just a kid ensign drafted for his brains. He'd been ordered to get away in a lifeboat. Then all of a sudden the lifeboat comes screaming back, and the aliens must not have been paying attention because they never touched him. He rammed this one," Pops said, patting the remains of the ship with his hand, "on the nose of the shield, and the front crumpled to nothing. The other ship turned tail and ran after that. And I mean ran. Wait until you see the pictures on that."

On a strong hunch, Dykstra asked, "What was the ensign's name?"

"MacTavish. Steven MacTavish. We called him Mackie. Quiet kid. Newlywed. Did brilliant work but wanted nothing more than to get back to his wife."

"I knew it," Dykstra whispered.

"Eh? You knew him?"

"No. But I know his wife. He had every reason to want to come home."

"Tell her she should be proud," Pops said. "It won't help her much right now, but he saved us. A lot of others aren't feeling the pain she is now because of what he did."

Dykstra frowned. "I can't tell her. Security. She thinks he died on a battleship."

"That's bullshit! She has a right to know. Screw the regulations!" Pops said.

After Pops left, Major Moore arrived with Vander Kam and Hague.

"Here it is, Dr. Hague. The Phinon FTL drive engine. It's all yours to tinker with," Moore said, like a father to a half-witted son.

But Hague did not look delighted at the prospect of opening up the engine. He looked scared.

"Go ahead," Moore said. "Go look at it, Dr. Hague."

The diminutive scientist approached it slowly, revulsion evident upon his face. He reached out tentatively to touch it.

"He's afraid of it," Vander Kam whispered to Dykstra.

Dykstra just watched.

"No!" Hague said, backing away. "No, no, Major Moore. No! It's not right. It's not a right thing! It's not a right thing."

"But Dr. Hague, you've got to look at . . . it . . ." Moore said, confused.

"No! No, I won't! I won't! No, no, no. It's wrong." He started to cry. He turned to the major, grasping his sleeve. "Don't make me touch, Major. No, please, don't make me," he pleaded.

"But, Doctor—"

"No!" Hague screamed. "No! It's wrong! It's a wrong thing! No!" He bolted out of the lab, a fast scurry with his short legs.

"Oh, damnit!" Moore said.

"Dr. Hague is not a normal scientist, Major," Dykstra said. "He's an autistic savant. It may be that he literally cannot deal with something as strange and *alien* as that drive."

"You'd like that, wouldn't you, Doctor?" Moore said hotly. "Well don't count on it. We'll get Hague psychiatric help, or sedatives, or whatever the hell it takes. But he'll work on that engine, goddamnit!" He stormed out.

"I don't think so," Vander Kam said,

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watching the major leave. "He doesn't know Hague like I do. Do you know Hague has to have his tea every day at exactly 1600 hours? If it's late in coming, he goes absolutely berserk, kind of like he just did. If he doesn't want to work on it, he won't work on it. End of discussion." He punched Dykstra lightly on the shoulder. "Congratulations. She's going to be your baby."

That evening Dykstra scanned the new material in the Slingshot file. Pops and his crew had brought in the actual data cubes from the Slingshot computers.

He found the records dealing with Steve's heroics, but not of the second ship escaping. Those records would be available tomorrow, and he'd see them, with everyone else, at the afternoon seminar.

Among the records was a transcript from the voice log of Steve's lifeboat: *SM: "I'm out, speeding up fast . . . there's the ships . . . oh! There goes the perimeter battery. . . ."*

Voice identified as Lt. Nick Malloy: *"Steve, is that you running?"*

SM: "It's me, Nicky. Turning tail and bolting for the blue."

NM: "Godspeed, Steve. Tell them what's happening."

SM: "Where are you?"

NM: "Right where you left me—the tracking room. We've lost half the personnel. Tell my wife I love her. Shit! He's making another pass."

SM: "Where is Pops?"

NM: "Out in the Ranger, *trying to fight them. He doesn't have the firepower, though. Brave son-of-a-bitch. I can see him now. You should be able to see him, too."*

SM: "Got him. He's vectoring . . . rocket away. A hit!"

NM: "They didn't even move. Oops! You see that? The bastards winged him!"

SM: "Pops, are you out there? Do you need help?"

Voice identified as Cmdr. Roger Tykes: *"Of course I'm here, Mackie. Get the hell lost! That's why they put you in that lifeboat."*

SM: "But—"

RT: "No, goddamnit! Your duty is to get clear. You may be the only record that gets out of here!"

NM: "They're releasing another rocket. Oh my God. . . ."

SM: "Nick!"

NM: "Good-bye," Heavy static.

SM: "God, Oh, God!"

RT: "Another micronuke. Don't know why they don't just blast us to smithereens . . . hiss and crackle *. . . damn signal is breaking up."*

SM: "I've got an idea, Pops. I'm turning around."

RT: Unrecognizable . . . *No, your . . .* static."

SM: "I can't run out, Pops. I think I can get one ship. Their shields are like ours. I can ram, use the lifeboat like a KKV, collapse the shield."

A tear trickled down Dykstra's cheek as he read the account.

SM: "Getting close now. Suppose I should have some final words . . . I love you, Sammi . . . but I have to do this . . . remember John 15:13. . . .

"Time to tweak the course. My target is still dawdling around. The other is hanging with him, just popping off

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shots. There—that should do it. Let's see what we can leave for Christmas. . . . .

"Eight seconds. Good-bye, Sammi. I love you. Take me now, Jesus. Take this you son-of-a—!"

The account ended. Dykstra stared at the screen.

He knew. He knew he could leave the tail intact. "It wasn't enough for him to just save his friends. He had to give us a shot at having their faster-than-light drive, too." Whispers.

He gave up his life for that. And his widow doesn't even know.

But I do. He thought of Sammi, the smile, the twinkle in her eyes. He thought of the shattered woman at the funeral. He thought of the alien drive, and Hague horrified. Opening it was his last chance to understand it.

The options were clear.

"Keep quiet, and stay. Tell her, and be sent away."

When I was young it wouldn't have even been a choice.

Lt. Nachtegall was worried about his friend. As he walked to the briefing in the tracking room, he thought about what Chris had been through, what had turned him *old.*

He'd noticed the change after he'd returned with Hague, though it had started before, with the destruction of Dykstra's home. Then Hague had become the new *wunderkind,* Dykstra's project had slipped away from him, and even the Hague Limit had turned out to exist. Following that, weeks of failure at trying to build a theory of FTL drives.

And sandwiched among them, a meeting with a delightful Samantha, followed by a funeral for her husband.

Nachtegall had read Dykstra's biography—he knew what sort of memories that must have brought back to the old man.

And last night, a new concern was assaulting his friend, though he wouldn't tell Nachtegall what it was.

The lieutenant turned a corner, took a dropshaft down two floors, entered another long corridor. Almost there.

After leaving Dykstra last night, the lieutenant had ferried some of the technogeeks out to Luna City, and joined them at a popular club.

At one point the conversation had turned to Dykstra. The others had also noticed his rough mood. One young scientist remarked that anybody would be depressed at not getting anywhere on a problem for a month. Dr. Manlinkov snorted. "Ah, that's the problem with being such a mind as he is. All his life it has been easy for him. Now he fails to overturn the foundations of physics in only one month, and this troubles him. Hmph! I should have such troubles."

Then the conversation had turned to Moore. The scientists didn't like him at all. "He feels threatened by Dykstra," one said. "We're all threatened by Dykstra," another laughed. "It's not fair, though. Dykstra earned all of his respect. He shouldn't have to take guff from a pinhead like Moore," the first retorted.

Nachtegall stood before the door to the tracking room. He'd tell Chris about last night, that the others liked

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and respected him. Maybe it would help. Sometime after the briefing, though. He entered.

All The Phinon Project scientists were there. Chris Dykstra stood leaning on his cane, eyes tired, looking like he felt every one of his years. Major Moore was smugly directing the man at the viewer controls to call up the Slingshot material, their first look at the alien spacecraft activating its FTL drive as it fled the base. There was Rick Vander Kam, standing next to Dr. Hague, who was fidgety and agitated, staring only at the floor.

Dykstra tried to speak to the major. "Major, you wouldn't see me earlier, but before I view this—"

"Wait until after the briefing, Doctor," Moore said, irritated.

"You may not want me present at this briefing."

"Lt. Jones, continue with your work," the major said to the man at the console. He faced Dykstra. "This briefing will continue on schedule."

Dykstra persisted. "Very well, Major." He took a resigned breath. "I'm going to tell Samantha MacTavish how her husband died. As soon as this briefing is over."

Moore was livid. "That's insubordination, *Doctor!* And this is wartime—"

"Lighten up, Major," a voice called from among the scientists.

Nachtegall stepped in. "Hang on, Chris. Sir."

On the big screen, the stars burst into view, then swung sideways until the camera locked onto the alien ship, a vessel of odd twists and turns.

"What seems to be the problem?" Nachtegall asked.

"The major won't tell Samantha that her husband died at Slingshot. That he is the one responsible for both saving the base and getting us the alien drive unit," Dykstra said.

"She has no need to know," Moore said. "Now sit down." He looked at the screen and addressed the gathering. "Here is the remaining alien ship. Notice carefully. . . ."

"Is that true, Chris?" Nachtegall whispered.

"Yes."

". . . Patterned in a twisted torus," Moore continued.

"That's wrong, Major!" Nachtegall interrupted. "Samantha has a right to know. She's no security risk! Hell, she already knows more about the aliens than—"

"That is enough, Lieutenant! You are dismissed. Confine yourself to quarters. And you, Dr. Dykstra—" he began, but Dykstra wasn't listening.

Dykstra stood transfixed by the screen, his eyes focused on infinity, his mind a million light-years away.

On the viewscreen, the alien ship turned rapidly. The tail section began to waver, then the ship was gone, just a streak into the deep heavens. The data readout in the upper right corner of the screen indicated an acceleration of two hundred million gravities.

A scream came from the back. "No! No! It's not right! A wrong thing!" Hague was crying, shuddering, trying to hide inside himself. "No, no, no, no-no-no-no-no-no." He slid to the floor. Vander Kam stooped to help him.

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* * *

Dykstra couldn't take his eyes off the screen. There was the ship, the tail wavering, like he was viewing it a hundred meters away over hot pavement. Then, zoom, gone, at an acceleration of two hundred million *g*s. No, it had to be an *apparent* acceleration. Yes, and that would mean. . . .

Nachtegall was watching Dykstra. "Staring off into infinity, seeing things no others can see, nor even imagine." That's how the biography had put it. The lieutenant was seeing it now.

It was there, all of it, laying itself out. Faster than he could consciously think, his wonderful, peerless mind assembled the answers before him.

Of course the causality paradoxes would go away if. . . .

Yes, the transition to hypervelocities had to take place at minimum. . . .

Trying to cross the Hague limit in FTL drive would. . . .

It was coming to him, unfolding, like the hand of God unrolling a scroll before him.

You are James Christian Dykstra, and through you, God will give Man the stars.

"Look at him, Major!" Vander Kam was pointing at Hague. "Look what you've done to him!"

"He'll be OK—"

"He will not!" Vander Kam shouted. "He's not your little tin soldier to push around and command. He can't handle this! He's not emotionally equipped for it, you idiot!"

THWAK. Dykstra slammed his cane on the table. "Enough!" he said, and everyone listened.

"He's back," Nachtegall said, awed. "He *knows.*"

"Rick, take Dr. Hague home, please." Dykstra said.

"Now wait one damn minute, Doctor!" Moore spat.

"Silence!" the old man said, eyes ablaze, again slamming his cane on the table. No one moved. The scientists bearing witness hushed. Moore, always more paper-pusher than soldier, shut up.

Dykstra continued. "I now know how the FTL drive works, Major. Do you understand what that *means?* For the war effort, for the human race, for the future, Major? Do you understand what it means for *me,* Major? Do you understand what it means for *you?*"

Nachtegall saw the passion, the sparkle, the fire in Dykstra's eyes, young again. This was the man he'd read about, the foremost genius of the age, as he must have been in his prime.

As he was now.

Major Moore backed down. "Dr. Dykstra, I'm sure we can work something out. Let's not remain angry."

Dykstra laughed. "Your reasonable attitude delights me. Major, I will continue to work for The Phinon Project. And I will give us a faster-than-light drive."

Dykstra started for the door. "But before I actually write anything down, I have another chore to attend to. Lt. Nachtegall, will you give me a lift to Luna City? There's a certain young widow I must visit tonight."

* * *

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As the boat lifted out of the hangar bay, Dykstra looked over at the makeshift lab that caged the alien drive. *I've defeated you, foul engine. You'll keep no secrets from me.*

I don't understand your maker. I don't know if he has a soul.

"We'll be at Samantha's in no time, Chris," Nachtegall said.

But I do. ■

Editor's Note: This story is a companion to "Sunshine, Genius, and Rust," which appeared in our May 1993 issue.

IN TIMES TO COME

Stephen L. Burns doesn't write a *lot* of stories, but the ones he does tend to impress you. As you've probably noticed, they also cover quite a wide spectrum. Next month he gets the cover for "Showdown at Hell Creek," a novelette with an intriguing answer to a question a lot of people are trying to figure out—and some of the most engaging aliens we've met in quite a while. And yes, it *is* as wildly funny as the cover suggests.

The other novelette, by Joe Martino, has a far future setting, but suggests a disturbing possibility that may be happening right now. Trouble is, we wouldn't know where to look. . . .

G. Harry Stine's fact article, "Comes the Revolution. . . ." offers possibilities that are far less disturbing—*if* we can find a way around the hurdles between where we are now and the tempting future he portrays. As usual, those obstacles are more political than technological—but solving them is an integral part of making the technology work.

We'll round out Mid-December with short stories by Bud Sparhawk, Paula Robinson, Jeffery D. Kooistra, and Mike Moscoe. One of them is even "seasonally correct"—but I'm not going to tell you which one it is!

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Stephen L. Gillett, Ph. D.

BEYOND PROMETHEUS

Prometheus, they say, brought God's fire down to man
And we've caught it, tamed it, trained it, since our history began.
—Jordin Kare, "Fire in the Sky"*

We could call it the "Prometheus paradigm"—the mastery of fire that sets humankind off so sharply from the other animals. And indeed, Prometheus's fire is a metaphor for technology, as Kare's song indicates (as does also, for example, Ben Bova's book of technology essays and stories *The Prometheans*).

But the metaphor ignores the fact that fire—or heat, more generally—is a pretty klunky way to manipulate the Universe. It guarantees waste; it guarantees that you throw away some of your hard-won energy, rather than turning it into useful work. Thermal processing is simple, to be sure; that's why a bright *Homo erectus* could pick up on it, multiple hundreds of thousands of years ago. But fire as a sweeping metaphor for "technology" merely underscores our vantage point from the Paleotechnical Era.

For heat is dreadfully disorganized energy. Although "energy is conserved"—the First Law of Thermodynamics—all forms of energy are not created equal. If you have a choice, get your energy as *anything* but heat! Otherwise a large fraction of the energy is simply unusable. You can't recover it or do useful work with it. It's been lost. Forever.

This stems from the Second Law of Thermodynamics: the entropy of a closed system increases. That is, disorder increases in spontaneous processes. A glass of water doesn't spontaneously unmix into ice and steam—even though total energy would be conserved in the process. A hot iron plunged into cold water doesn't heat up. And so on and so on, through numerous examples buttressed by both experiment and everyday experience.

*From the song "Fire in the Sky," copyright 1991 by Jordin Kare. Used by permission. Cassette tape available from Wail Songs, Inc., PO Box 29888, Oakland, CA 94604.

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Sure, thermal energy is just mechanical energy at the molecular level—but here in the real world we're not dealing with the molecular level. A recent SF compilation on "Power" was fuzzy on the distinction. Although it emphasized the "amount and degree of concentration available" of energy, to judge by the examples given (coal and oil vs. wind and water) the writer did not distinguish between thermal and non-thermal energy—between the degrees of organization of the energy.

We'll see why the distinction is vital—and how focusing on "energy" alone is misleading—below.

Carnot Knowledge

Carnot's cycle is one expression (albeit an elegant one) of the Second Law. It's named after Sadi Carnot, the French engineer who discovered it about 1824 (!—that's not a misprint). He showed that only so much heat can be turned into useful work; the rest must be dumped back into the environment. This is Thermo 101 now, but it was an astonishing achievement for his time: he demonstrated this before "heat" was known to be a form of energy (in fact, Carnot's original paper speaks of "caloric"); indeed, before there was a clear concept of "energy," much less that energy is conserved. (Carnot's notes, published posthumously almost 50 years later, showed he had grasped the conservation of energy; alas, though, before he could follow through on these ideas he died prematurely of cholera, at age 32.)

So any thermal plant—from Watt's original steam engine to a car's internal combustion engine, from a steam turbine to a nuclear power plant—is fundamentally limited in its efficiency. It *must* dump heat; it *must* waste a goodly percentage of the thermal energy it's given. The possible efficiency depends ultimately on the temperature difference—the "delta-T"—between the source of the heat and the "sink"—the cold body to which the heat flows. The greater the delta-T, the greater the efficiency (assuming good engineering, of course!) For conventional thermal plants, it's on the order of 20-40%.

This is a limit set by laws of physics. You can stretch it by clever engineering: magnetohydrodynamic (MHD) technology, for example, can get better efficiencies than conventional turbines because the temperature of the working fluid—a plasma—is much higher than the temperature of steam, so the delta-T is greater. But nonetheless, no amount of clever engineering can get around it completely.

Of Elements, Entropy, and Partition Coefficients

It's worse. Thermal technology covers much more than machines limited by the Carnot cycle. Heat pervades our present ways of doing things.

Take resource extraction, for example. Today's technology for extracting resources mostly boils down to heat and cool and wait for phase changes: freezing, melting, crystallization; the remarkable (and so far poorly understood) phenomena

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whereby huge numbers of atoms spontaneously organize themselves as their average energy (i.e., their temperature) changes. You just choose a set of heating and cooling steps so that the element is purified (and so that you don't have to add any more heat or outside reagents than necessary).

This works as follows. The atoms of a particular element will distribute themselves between coexisting phases depending on which environment the atom "prefers."

Let's look at a geologic example. If you've got two different types of crystals forming in a cooling magma, often atoms of particular elements are (mostly) going into one crystal, while different elements are going into the other crystal. For example, suppose sodium-calcium feldspar ($(Na,Ca)(Si,Al)AlSi_2O_8$, plagioclase) and olivine ($(Mg_2,Fe)_2SiO_4$) are both crystallizing. Then most of the magnesium and iron are going into the olivine, while most of the sodium and calcium are going into the plagioclase. By contrast, oxygen and silicon are going into both.

Such element "preferences" can be expressed by "partition coefficients": the ratio of the element concentration in one phase (one crystal, say) to the other (the melt or the other crystal). (By the way, geochemists use partition coefficients all the time to infer the temperatures and pressures under which minerals crystallized.)

Now, if an element's partition coefficient is very different from unity, it means it *really* prefers one phase to another. This is the basis for thermal separation: set things up so that the element you want is extracted into one particular phase; then just use physical means to separate off that phase, and throw the rest away.

For example, nearly all copper ores are complex sulfides containing not just copper but lots of iron and significant amounts of things like antimony and arsenic. To separate them, you make a molten sulfide "matte" to which some lime (CaO) and/or silica (SiO_2) have been added. The matte is oxidized in air, which drives off the sulfur as sulfur dioxide (SO_2). (Which is why old-time smelters were bad neighbors, too; in the Bad Old Days that SO_2 was just vented to the atmosphere.) Meanwhile, the iron oxide formed combines with the lime or SiO_2 to make a silicate melt ("slag") that floats atop the molten copper. So you've ended up with two immiscible liquids, like oil and water, and you can just drain away the copper. (And throw all the iron-rich slag away.)

Sure, it's simple (even though I've left out a lot of details). But although using the spontaneous self-organization of huge ensembles of atoms to separate the ones you want from the ones you don't want is straightforward, it's also pretty crude.

For one thing, it's *extremely* energy-intensive, as it consists of multiple steps of heating and cooling.

For another, it requires lots of (generally) expensive reagents, which are added to facilitate the phase changes. The silica or lime added in the copper smelting example above are one example. And these

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reagents themselves had to have been purified (usually thermally) in the first place.

Thermal extraction is also practical only with concentrated raw materials. Why? For several reasons:

(1) Partition coefficients are never infinite; or as geochemists say, there's a little of anything in everything, and a little of everything in anything. So this means that some of the element you want always goes into one of the "other" phases, where it's lost. Some copper is always lost into the slag, for example; and such losses can be significant in the economics of a mine or smelter. (Depending on the element you're extracting, such losses can be a pollution problem, too.)

For another example, consider the smelting of iron. You take nearly pure, naturally occurring iron oxides ("ores") and cook (!) them with carbon, in a process that goes back to antiquity:

$$Fe_2O_3 + 3\ C \rightarrow 2\ Fe + 3\ CO.$$

Molten iron sinks, and molten silicate impurities float: again you've ended up with a two-phase system in which you have two immiscible liquids. And the iron partitions into the molten metal rather than the silicate. So you can drain the iron off and throw the slag away.

But: *some* iron goes into the slag (this is why slags are generally dark-colored, by the way). It's just that at a couple percent or so, it's not worth worrying about. Metallurgists, in fact, worry much more about the physical properties of the slag—such as trying to keep it fluid at as low a temperature as possible, for example—than about minimizing the metal lost into it.

Steel slags, by the way, are much richer yet in Fe—typically about 40% FeO. Making steel requires oxidizing the melt to get rid of dissolved carbon—steels are basically low-carbon iron alloys—and when you do *that,* some of the iron also oxidizes along with the carbon. As we saw, slags from copper smelting also contain a lot of Fe, because iron sulfide is a pervasive impurity in Cu ores (in fact, a beneficiated copper sulfide feedstock typically contains more iron than copper). The same is true of lead.

But none of these slags are iron ores. (Yet, anyway.) For one thing, the iron is usually in silicates—mostly fayalite, Fe_2SiO_4—rather than oxides, and silicates have so far been impractical to deal with. (For a little perspective, by the way, such slags are richer sources of iron than anything we've yet seen on the Moon.)

So, you can see that the problem of elements partitioning into undesired phases gets worse and worse with low-grade sources. Ultimately you end up losing as much—or more—of your element into the slag or tailings as you recover.

(2) The purer the deposit, the fewer steps you need to deal with it. You need to dig less rock to get it out, use less heat to heat it up, and add less reagent to react it with. You also have fewer side reactions, due to impurities in the rock, to consume your expensive reagents. Obviously this has an extraordinary effect on the economics of the operation. (Even so, you still generally need prepro-

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cessing—"beneficiation"—to make a feedstock that can be smelted.)

(3) Natural materials are messy. They are highly heterogeneous both physically and chemically, and can vary greatly in composition and texture on very small scales.

This is why humans are still so deeply in the loop in extraction technologies. It's not that the mine operators *like* dealing with the UMW, it's that the very digging of the deposit requires on-site local intelligence. Where's the vein versus the country rock versus the overburden? Where's the fault that slices off the edge of the deposit? How, what, and where to *dig*—such a "simple" thing still defies automation. (And it's why, by the way, most of the scenarios calling for automated processing of extraterrestrial material are merely a source of mirth.)

Tiny variations: vagaries of grain size, degree of fracturing, local presence of undesirable impurities, and so on and so on—make the difference between an economic mine and an expensive hole in the ground. (Another point missed by lots of space-development enthusiasts in their extraterrestrial mining scenarios—but I'm digressing again.)

But sure, thermal extraction technologies are simple. You can stumble across thermal extraction by accident. And we've since built up an entire paradigm around "resources"—ores, natural concentrations that can be dealt with in this way. But we're still using the same basic approach as that first bright prehistoric person who noticed that he (or she) got beads of metal when he built a fire on a certain type of rock. (Extractive metallurgy is very complicated even in the light of modern chemistry, by the way—that's why it was encrusted with so much folklore, and why *it* took so long to sort out.)

If you're wondering where those concentrated ores that we mine came from in the first place, they're largely products of natural thermal processing on a huge scale, and typically over a very long time. Consider, for example, a "porphyry copper" deposit, the source of most of the world's copper. This is a large granitic body in which copper-bearing sulfides are dispersed. Because sulfides have quite different physical properties from the common rock-forming silicates that make up most of the rock, it's practical to use physical separation techniques (flotation, mostly) to separate the (useful) sulfides from the (useless) silicates (the "gangue").

How did these porphyries form? Granite is an igneous rock; that is, it crystallizes from a melt. As the porphyry granite crystallized, a sulfur-rich fluid phase "exsolved," much as CO_2 comes out of a freezing can of soda pop. Lots of useful metals partitioned preferentially into that sulfur-rich fluid, and so ended up in sulfides dispersed throughout the larger mass of rock, where even our technology can deal with them. (The details are actually fairly well understood; see Burnham, 1979, for example.) However, because partition coefficients aren't infinite, all the copper didn't end up in the sulfides. There's still

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lots of Cu in the rest of the granite . . . it's just not practical to get.

So, those natural deposits we seek out themselves represent the application of huge amounts of heat to huge amounts of material, with nature taking its leisurely course. (A large granite body can take several million years to cool.) And it's why you get discouraged if you think of resource extraction in terms of thermal technology.

The Resource Fallacy

As they did in *Limits to Growth*, I used to think that the single worst assumption in *Limits to Growth* was "Only One Earth." In fact, though, it's not the worst and not the most immediate. The single worst assumption is that rising industrialization means rising pollution. (An implicit "truism" still seen in any number of naive SF satires, too.)

But it's not true. It's merely another prejudice from our vantage in the Paleotechnical Era; from our extensive use of messy, cumbersome—and heartbreakingly inefficient—thermal technologies because we don't know any better.

Why has this perspective been missed? Our thermal-technology blinders again. If you consider dealing with low-grade resources as I've described above, you realize that lower and lower grades yield diminishing returns. The partition coefficients get to the point that the "slag" or "tailings" you're throwing away contain as much of the element you want as the extract that you're saving.

This is why the Club of Rome modelers dismissed technological developments as a solution to the "resource problem." It is fundamentally built into their model that processing lower and lower grades of "resources" inevitably lead to more and more pollution—and they certainly never dreamed of treating the "pollution" as itself a resource!

But you see what's happening; recovering desired elements from low-grade sources, and pollution control, are the same problem approached from different ends. In both cases, you're trying to extract (relatively) few atoms (desired in the first case, unwanted in the second) from a vastly larger background of other atoms.

And that's expensive and cumbersome to do thermally.

Sure, there's an irreducible cost; you can't increase order without spending energy—that's the Second Law intruding again. This ultimate limiting cost is the change in the Gibbs free energy (ΔG, for short) between the initial and final phases. (Actually, ΔG applies to processes carried out at constant pressure, for you purists out there.)

ΔG contains three terms:

(1) $\Delta G = \Delta U + P\,\Delta V - T\,\Delta S$

The first term, ΔU, the change in internal energy, is easy to understand. It's simply the difference in chemical binding energy between the two configurations of atoms. The second term, pressure times the change in volume ("ΔV") measures work done on the environment from any changes in volume. That's small for solid or liquid phases, but large for

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gas phases; this term, in fact, is the important one in thermal engines. A steam engine or turbine does useful work, for example, by using the change in volume as water becomes steam.

The third term is the tithe exacted by the Second Law. It's set by the entropy difference—ΔS—between the two phases. (Entropy has units of energy/temperature — joules/kelvin— so temperature times entropy has the dimensions of energy.) And why the minus sign on this term? Because positive ΔS means increasing *dis*order, and so a positive ΔS means that entrophy increases during the reaction. In turn, such an entropy increase makes ΔG smaller than it would be if there were no entropy change, because T ΔS is subtracted from the other two terms. In other words, you can swap energy for disorder.)

Note also that this equation means we should carry out a process at as low a temperature as possible; for the higher the temperature; for the higher the cost in disorder, because T ΔS is bigger. This is a far cry from the wholesale melting, vaporization, and cooling—often in multiple steps—that's characteristic of extractive metallurgy (and chemical engineering) today!

The first two terms don't say anything about the grade of a resource deposit. But intuitively, we expect that there has to be *some* extra cost for processing low grade material. Increasing order costs energy. And sure enough, that comes from the ΔS term.

Let's find the ballpark limit for this extra cost, using a very crude BOTE* calculation of entropy difference. If a source is ten times less concentrated, the additional entropy is roughly ln(10/1), where ln is the natural logarithm.

Ln(10) ~ 2.3. So, at constant temperature it should only be 2.3 times more costly in energy to extract an element from a deposit that's 10 times less concentrated.

There's *lots* of room for improvement in our current extraction technologies.

Work Smarter, Not Hotter

Well, obviously the opposite of thermal technology is non-thermal technology.

And we have some examples. One actually goes back to the last century: Electricity. It's highly organized energy, even if made in thermal ways. Electric motors, for example, are not heat engines, and so their efficiencies aren't limited by Carnot's cycle.

In fact, using the thermal paradigm, we can scrutinize power sources.

For one thing, conventional (fission) nuclear power fares poorly —it's just another thermal technology, Carnot cycle-limited, that creates heat that must be rejected. It's even one that creates more entropy than usual. Fission waste is a mishmash of radioisotopes that are difficult to store—and difficult to separate.

Sure, it's simple, but it's hardly 21st century.

Fusion doesn't fare much better.

*Back of the envelope.

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Again, all you're doing is making heat by letting nuclei rearrange themselves, and then channeling some of that heat by glorifications of 19th-century techniques.

(Of course, geothermal power or such schemes as ocean-thermal-energy-conversion [OTEC] are thermal technologies, too; but at least in those cases we're exploiting heat that's already there, rather than making heat and then trying to deal with it.)

Solar power satellites (SPSs), on the other hand, fare very well —they're sending down highly organized energy (microwaves) which can then be converted directly and non-thermally to electricity. The only heat generated is due to inevitable efficiency losses, which have no fundamental limit set by the laws of thermodynamics. (To be sure, efficiency losses make the only heat on the *ground*. Depending on the mechanism by which the power that's beamed down is generated, though, an SPS may involve a thermal technology. But off the Earth, with all that sunlight flowing past 24 hours a day, that's not so critical.)

As far as that goes, you often hear a mantra that "sunlight is simply too diffuse" to run a technical civilization. Well, it just may not be so. It depends on how cheaply you can gather the sunlight; and what you're trying to do with it once you've got it. Agriculture remains economic even now; and the methods green plants use to gather sunlight aren't even terribly efficient. But they're sure more efficient than thermal methods!

Don't write off even ground-based solar. And before dismissing even high-efficiency solar cells as inadequate for powering a technical civilization, first consider if you're trying to run thermal technologies with them. Sunlight may only be too "diffuse" to run a paleotechnical civilization.

Vehicles, of course, are profound heat sinks. I've seen estimates to the effect that the typical internal-combustion powered vehicle is only 15% efficient, between its Carnot-limited engine and its aerodynamic drag.

So there's lots of room for improvement here, too. Even if we continue (for the nonce) fueling cars with petroleum, for example, we could get a lot more energy out of each mole of gasoline if we didn't burn it. Electrochemists have dreamed, for at least a generation, of a fuel cell that could use hydrocarbon fuels. You wouldn't have to dump over 50% of the energy of the gasoline as heat, and you'd get more energy with less pollution. (You could oxidize the fuel completely to CO_2 and water, with no carbon monoxide, unburned hydrocarbons, and the other scuzzy debris that high-temperature combustion leaves behind.)

This dream is not something that's fundamentally limited by Carnot's cycle, either. It's just limited by engineering ingenuity (and by our ability to manipulate materials).

But, as I argued above, Carnot's limits are only part of the problem. Thermal techniques run deeply throughout our present approaches to doing things.

So let's take a look at resource ex-

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traction again. Surely there are better ways of separating elements than our present cycles of melt, freeze, vaporize, and condense?

There are. Biological systems give some proofs of concept: of non-thermal element partitioning. Consider the lowly kidney, for example. It's hardly the most glamorous organ in the body, to be sure! But what it does is marvelous. It extracts specific molecules from the blood with high efficiency. And it does it isothermally, too, which keeps the energy cost close to ΔG. No mucking around with heating and cooling and phase changes.

Plant roots are another example. Using highly specific proteins as element receptors, plants scarf elements they need out of the ambient environment, atom by atom.

It's not exactly hubris to think what nature can do, we can do better.

One non-thermal extraction technology is electrodialysis. This uses certain organic membranes that, when a current is applied, will attract and pass certain ions (charged atoms) from aqueous solution. So you can pull the ions out of water solutions. It's still a bit klunky, because the dialytic membranes are mechanically weak and liable to gum up. But electrodialysis is being used commercially to desalinate seawater, in such places as Saudi Arabia. And it's obviously much more efficient than a thermal desalination process involving phase changes—evaporation and recondensation, say. (If you wonder why coastal California is dithering about a "water problem," and still brings its water hundreds of miles from the Sierra Nevadas, while the vast Pacific sits there ignored—well, so do I. But I'm digressing.)

Here's some perspective for extraterrestrial resource scenarios again: seawater's a better potential resource than virtually anything we've seen Out There. By the standards of lots of places, it's practially pure water. And it contains lots of other things in a form that's pretty easy to deal with. Magnesium and bromine, for example, have been extracted from seawater at least since WW II.

With non-thermal extraction technologies, seawater becomes ore—and the "waste" product is fresh water.

In fact, with this perspective everything's potentially a resource. Using sufficiently sophisticated, non-thermal technology we should be able to pull out the silicon, aluminum, iron, etc. directly from ordinary rocks. (And also break up any pollutant—*any* pollutant, however dispersed—into useful forms. As the old saying had it, pollution's a misplaced resource.)

(Another amusing perspective: I've seen a naive analysis of lunar regolith that noted it was mostly "demandite"—i.e., a fictional substance containing the elements in the proportions demanded by industry. To first order, though, common Moon rocks have the same composition as common Earth rocks, but we don't use common rocks as resources. (Yet.) So why is it practical to go to the Moon, at enormous expense and extremely far from infrastructure, to

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gather ordinary rocks for resources? Particularly when the extreme waterlessness of the Moon means any extraction processes will have to be developed anew! And if it *is* practical to extract elements from ordinary rocks why is there a resource problem on Earth? We don't need to go to the Moon to get them! This hasn't kept some naive SF writers from touting "demandite" as a reason to go to the Moon, though. And SF is s'posed to think things through....)

Anyway, if we *ever* run out of (say) aluminum or iron it'll be because (a) we're too stupid to replace our pathetic thermal extraction technologies with something more efficient; or (b) we've taken the planet completely apart!

For consider: aluminum is the second-most common element in the crust, and iron is the fourth-most common. Here's a BOTE calculation: consider Pisgah Crater. It's a little volcano (cinder cone) and associated lava flow that's nicely preserved alongside I-40 in California's Mojave Desert—about halfway between Needles and Barstow, for those of you who've been that way. The Pisgah lavas are basalt, a very common lava, and one that's iron-rich; basalts contain about 8.5% Fe on the average. So, by my estimates, the iron in this one piddling little basalt flow amounts to some 40,000,000 tonnes—or about the yearly U.S. output.

And something like 70% of the Earth's crust has a basaltic composition.

* * *

Trapped in the Thermal Paradigm

It's certainly true that with "sufficiently cheap energy" pollution would be a thing of the past, as a recent SF anthology puts it (except possibly for ultimately disposing of the waste heat itself!). And also, with enough energy even thermal technologies will work for extracting elements from low-grade resources.

But with a sufficently advanced technology pollution is also a thing of the past. And so are resource shortages. As I belabored above, there's no fundamental reason that separating elements has to be so energy-intensive. Not even the Second Law says so.

But thermal thinking pervades our present ways of doing things. Indeed, it will probably be considered the defining characteristic of the Paleotechnical. Using more and more energy is the only way people consider to do things.

At best, though, in thermal plants you're boosting efficiency merely by running things at higher temperature—increasing ΔT again. You're not doing anything fundamentally different.

And at worst, most of that "concentrated" energy is just going to waste. Consider chemical processing, for example. Temperature, of course, is a measure of the average motion of the atoms or molecules that compose something; the more energy they have, the faster they're moving, and the hotter the something is.

But it's just an average. Obviously a few atoms or molecules will be traveling much faster than the average.

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Statistical mechanicians and physical chemists call this the "Maxwell tail"—the few atoms or molecules that happen to be traveling much faster than the average.

They're important because they're the ones that let a chemical reaction happen; they're the few atoms that happen to be moving fast enough to surmount the activation energy barriers. Even for a process in which the reactions go "downhill" (i.e., are exothermic), it's the Maxwell tail that drives those reactions; it's that relative handful of molecules that have the energy to overcome the activation energy barrier.

And this means all those other atoms are just ginning around, doing nothing useful. All they've done is soak up energy, and disperse it into a less-than-useful form: heat.

Planet Capital vs. People Capital

"The future is a race between education and catastrophe."

—H.G. Wells

So: We need a paradigm shift. The old cliché that "knowledge is power" is becoming literally true, as Alvin Toffler noted in *Powershift*. This is what that "information-intensive economy" we've been hearing about for a decade is all about.

But thermal technologies are not information-intensive. It's hardly coincidental that the "second-wave" smokestack industries Toffler describes are overwhelmingly based on thermal processing.

The Prometheus Paradigm requires "hard, concentrated energy." But that's necessary only if you're thinking thermally, in which case you're not too concerned about the form of the energy because you haven't the skill or knowledge to deal with anything more sophisticated than heat.

For (say): what is the difference between elements concentrated in thermally extractable ores versus elements disseminated in ordinary rocks? It is technology, to be sure; but behind the technology lies the *knowledge* to deal with diffuse sources.

In fact, our present preoccupation with finding and exploiting concentrated resources that natural happenstance has gathered together—our "living off the planet's capital" by consuming "nonrenewable" commodities—will seem to our descendants as quaint as chasing the aurochs. They will find it preposterous that people were seriously worried about running out of iron or aluminum, when the crust is *made* of such elements, and especially when information technologies are making bulk matter less and less important, as George Gilder has noted in *Microcosm*. (By the way, a relevant fact for the information-intensive economy: silicon is the second-most abundant element in the crust.)

Beyond Prometheus: a "kidney" that purifies a waste stream from a factory, a city—or even a river or lake soiled with debris from the Thermal Era, and recovers valuable but toxic elements in the process (mercury, cadmium, lead . . .).

Beyond Prometheus: vehicles powered by fuel cells and miscellaneous

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fuels (biowaste? methanol? the details don't matter). And anyway, vehicles will be much less used anyway, because information transfer is so quick and convenient. (Your author already telecommutes as much as he can.)

Beyond Prometheus: an indefinitely "sustainable" (in the current jargon) high-tech society. As the environmentalists remind us, early hunter-gatherers could live indefinitely (at least till the next big asteroid strike), because their resources were automatically self-renewing. (Even though hunter-gatherers did cause things like the Pleistocene megafauna extinction in the Americas. They were hardly so benign to the biosphere as is commonly represented!)

Post-thermal humanity can also live indefinitely. Indeed, post-thermal humanity will be more benign than the hunter-gatherers, because they (presumably) will know better than to cause extinctions, and because they can mitigate natural hazards.

And, they don't even have to stick around for the next asteroid strike. ■

References Cited:

Burnham, C.W., Magmas and hydrothermal fluids, in H.E. Barnes, *Geochemistry of Hydrothermal Ore Deposits*, 2nd ed., pp. 71-136, John Wiley & Sons, 1979.

Gilder, George, *Microcosm*, Simon & Schuster, 1989.

Toffler, Alvin, *Powershift*, 1990.

> [An] observer will see the bizarre developments of behavior only in alien cultures, not in his own. Nevertheless this is obviously a local and temporary bias. There is no reason to suppose that any one culture has seized upon an eternal sanity and will stand in history as a solitary solution of the human problem. Even the next generation knows better. Our only scientific course is to consider our own culture, so far as we are able, as one example among innumerable others of the variant configurations of human culture.
>
> Ruth Benedict

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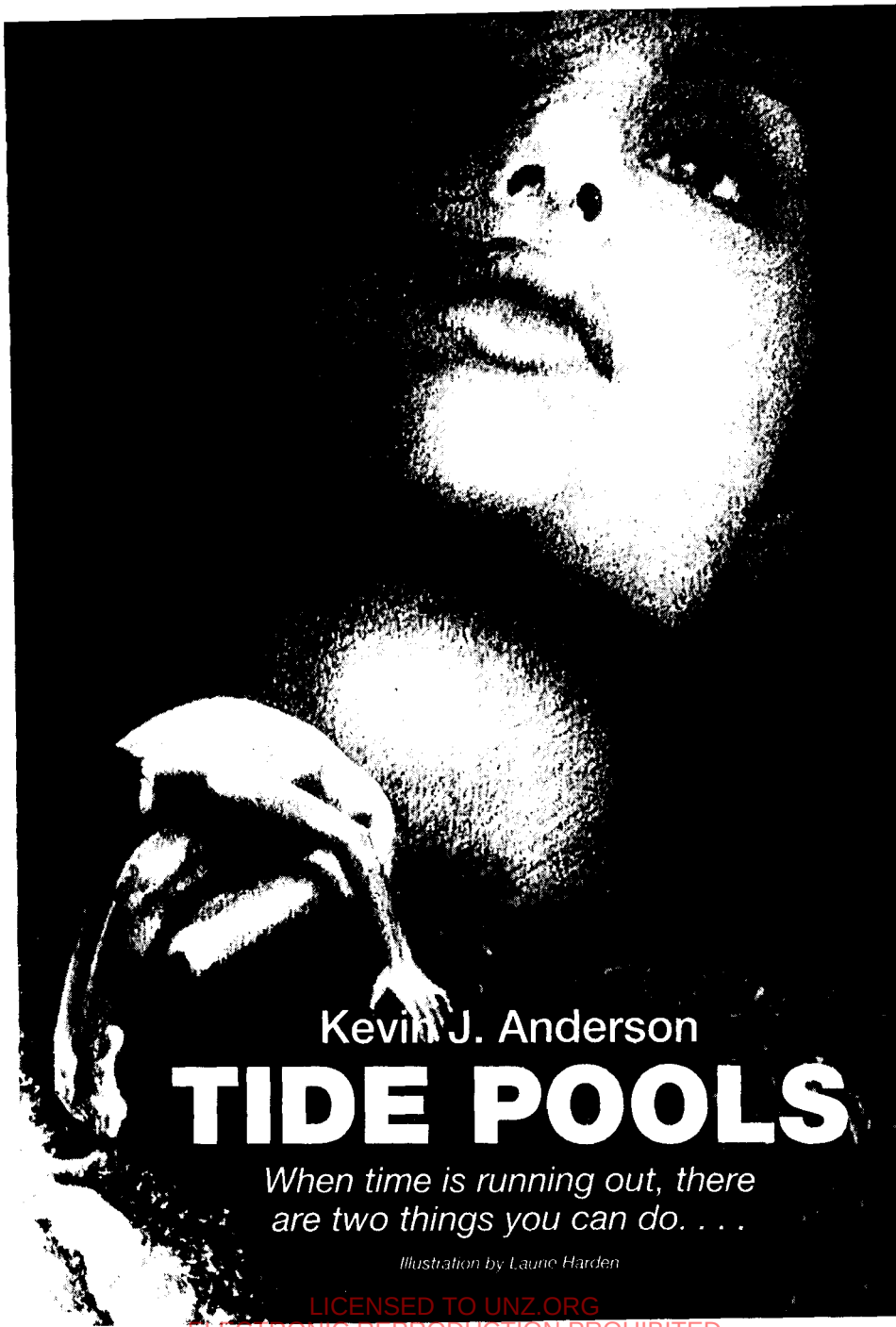

Kevin J. Anderson

TIDE POOLS

When time is running out, there are two things you can do. . . .

Illustration by Laurie Harden

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The return portal formed in the air like razor blades slashing through clear ice. Andrea stepped across the threshold, her mixed elation and disappointment so overwhelming that she barely noticed the skin-fizzing sensation of hopping back home from an adjacent timeline.

"I got something!" she called, unslinging the backpack from her shoulder. "How about a miracle cure for multiple sclerosis, anybody?" It wasn't what she had hoped to find, but she had to make it look good.

In the receiving room of Alternitech, portals and complex control panels surrounded her. At her announcement, technicians and other cure hunters began to pay attention. "How much follow-up do we need?" asked the chubby man in the operating booth.

"Not necessary—I got all the right data." Andrea brushed a hand through her short, sweat-rimed dark hair, feeling her cheeks grow warm.

Cure hunters like herself dreamed of such unlikely chances. Peeping into parallel timelines, digging through other-universe medical libraries, Andrea searched for effective treatments that doctors in her own timeline had somehow missed.

Who would have thought that a drug used for skin disorders would be amazingly effective against MS? When injected into the spinal columns of those suffering from the disease, the drug dissolved the small white plaques covering nerve sheaths.

No one in her own timeline *had* thought of it, but in an adjacent universe, a doctor had stumbled upon the treatment and published it to high acclaim. Alternitech would profit greatly from the discovery, and so would mankind.

The man in the operating booth spoke into his intercom, summoning verification reps to paw through her data. Other cure hunters applauded Andrea as they waited for their own gates to open. She surrendered her backpack and its contents to the security guard.

It was phenomenally expensive to haul foreign mass from other timelines. Hunters like Andrea recorded pertinent data onto the diskettes or videotapes they carried with them. Apparently, there was no cost to transfer *information* between timelines, though Andrea supposed the entropy specialists would probably come up with something sooner or later.

After the announcement of her discovery, the reporters would come, the television interviewers, the applause from the public, the heartfelt thank-you letters from MS patients given sudden new hope for their conditions. She allowed herself to revel in the times she made a find like this.

Andrea also felt a disappointment inside, despite the rewarding rush of success. After all, she had not been *looking* for a cure for MS. She had failed in her primary mission.

The problem gnawing at her was whether or not she should tell Everett. He was the one who had everything at stake.

Home at last, Andrea entered through the front door, propping it

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open to let in the fresh breeze. Sunlight gushed through the bay windows, warming the sunken living room.

Everett straightened from his work by the laser generator. "Andrea? Is that you?" She stood in full view, and he was staring directly at her. His eyesight grew worse every day.

"Expecting someone else to barge in and blow you a kiss?" she asked.

"I expected you home hours ago. Wait, I have to start all this up again!" He held up his hands, then felt his way around the equipment, squinting at it, careful not to stumble. "I have a surprise. Where are you? Come into the foyer—I've set that up as prime focus."

Andrea smiled to see him looking so earnest, so bustling. This was much better than the phase of moping he had gone through a month earlier. She went where he directed her and looked around the walls. Tiny faceted mirrors were mounted at strategic points around the room.

"Ta da!" Everett switched on his laser projector, and a 3-D holo sculpture congealed around her like a spider web of light, a kaleidoscope of rainbows. Each line was split, not quite resolved, so that it was really dozens of layered images overlapping each other, partially unfocused with chromatic aberration. His grids were out of phase, and she doubted Everett even knew it.

"My masterpiece," he said. "I wanted to leave something impressive behind. I call it *Timelines*. It's for you, Andrea."

Everett was looking at her with a childish expression of delight and anticipation on his face. His gaze was slightly off.

Timelines. She looked at the fuzzed edges of the light threads, the overlapping images that were almost but not exactly like each other. Perhaps it wasn't just some jittering lack of surety caused by Everett's fading eyesight and his trembling hands; timelines nearly overlapping but subtly different. He *must* have done it on purpose; she had to believe that, or else his failure would tear her heart apart. "I think it's beautiful, Everett. I don't know how you managed it."

He lowered his head to cover his smile. She almost expected him to say "Awww, shucks." Instead, he found a soft futon and sat down. "I was going to have it done by your birthday, but now everything takes me so damned long." He sighed. "Are you going to stay home with me tonight, or are you going back to Alternitech?"

Watching him made her wince her eyes shut. What good would a multiple sclerosis cure be for him? She had failed him at the time he needed her most. She had to keep searching.

Heidegger's Syndrome. The disease selectively attacked the myelin sheaths around the optic nerve, then chewed away at the medulla oblongata, deteriorating the nerves that controlled breathing and heartbeat. After a slow descent into blindness, Everett would one day just find himself without a heartbeat, then fall over and die. Andrea dreaded the morning she would wake up to find him cold in the bed beside her. She could not prevent it in any way.

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Andrea stared at Everett in the living room. The solution was painful and obvious. But Alternitech had flatly denied her permission to hunt among the timelines for a cure.

She walked up behind Everett, threw her arms around his waist, then pressed her cheek against his shoulder blades. The tapestry of light glittered around them, defeating even the sunlight. *Timelines.*

"It's your best work, Everett," she said. "I love it."

Andrea fidgeted in the university office of a man she had never met. In the halls of the Neurological Wing of the Deudakis Medical Research Facility, she could hear annoying sounds of construction, hammers and saws and power drills. She had to weave her way around scaffolding and construction barricades to reach Dr. Benjamin Stendahl's office. The hall lights flickered, but remained on.

She looked at her watch again, sat down in the only uncluttered chair, then stood up once more. Stendahl's computer sat on a corner of his desk, glowing with a garish screen saver of multicolored lines. She ran her fingertips along the spines of the journals on his bookshelves, stacks of dusty manuscripts, technical papers held together with old rubber bands; one band near the bottom of the pile had snapped, splaying curled printouts.

A man stepped into the office, breathing heavily and mumbling to himself. He came to a full stop as he saw her. His eyebrows were like fluffy gray feathers mounted on his forehead. "Oh! I forgot." He dropped a bulging briefcase atop the stacked books on his desk. "You're here to talk to me about Heidegger's Syndrome—your husband, right? Well, there's nothing I can do for him. You realize how rare the disease is? Only eight people a year are *diagnosed* with it in all of North America."

Andrea thrust her chin forward. "I've read all your papers. Looks like you were making good progress toward a cure. Why did you stop work on it?"

"Simple answer—no more money. That's the rotten part. Heidegger's isn't really an insidious bastard like cancer or AIDS. Given some research data, I could do a lot. But our rhesus monkeys were rerouted and never arrived. I could afford only one grad student, but she got married and moved to Ohio. I couldn't get her replaced before the end of the fiscal year, when my funding went away."

Stendahl sat behind his desk, jiggling the mouse so that the screen saver dissolved to display a master menu. "I think 'orphan disease' is the colorful term they have for it. With research dollars so scarce, who wants to waste time coming up with a cure for something nobody cares about?"

"I care about it," she said. "Eight people a year care about it, and so do their families, and everybody they know."

Stendahl looked at her with sympathy in his big, dark eyes. "Look, millions of people get cancer, leukemia, cystic fibrosis. Heidegger's just doesn't cut it. The disease was a medical curiosity when it was first reported, little

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more."

Andrea stared at the journals on his shelves. Pounding hammers from the hallway punctuated her sentence. "And now?"

He shrugged again. "I'm working on other things."

Andrea wanted to spend her every waking hour hunting alternate timelines for a cure, but she needed to be with Everett. Each day was like Russian roulette with him, never knowing which heartbeat might be his last.

Seagulls wheeled overhead, tiny checkmarks that screamed against the booming rush of the Pacific. The ocean and the huge sky above made the Universe seem oppressive in its grandeur. Headlands sprawled out in muted browns and grayish greens to the shore, where a string of tide pools dotted the wave-chewed rock like diamonds on a necklace. Barefoot and in cut-off shorts, Andrea and Everett picked their way among the rocks.

Andrea took sandwiches out of the pack, and they split a bottle of beer. Everett squatted beside one of the pools and dangled his fingers into the water, startling two crabs that ducked for cover beneath the rocks. He squinted to make out details. Eyeglasses would not help him; Heidegger's was not a problem of focus, but of the optic nerve itself.

The tide pools were colorful, filled with life, a microcosm of unfurled pale-green anemones, tiny fish, and shells. Snails worked their tedious way across the rock surface, finding rich patches of algae. Everett tossed a rock, watching the ripples spread to the boundaries of the tide pool, but constrained by the walls so that it could not affect the other tide pools.

"Each one is like its own universe," he said. "Full of life, nearly identical to the others, but different. I'm like an anemone in a tide pool, stuck to the bottom, waving my fronds in the hope that I'll catch something, but ultimately trapped right where I am. You, on the other hand, are more like one of those rock crabs. With Alternitech, you can scuttle over the wall and get to other tide pools, go see new places, look at what they've got, and maybe take something back with you."

Andrea didn't know what to say. She did indeed have the flashy, high-paying career. Who could imagine a world where a "research librarian" was considered a glamorous profession? Andrea was constantly being interviewed, receiving awards and applause. She had loved it—until the search had become personal, and desperate, and she had failed.

"I'm still looking for something to help you. I'll find it. Don't worry."

A wave curled against an outcropping partly out to sea, dashing spray into the air like tiny crystal droplets. Two gulls swooped down, then wheeled high overhead.

"Why help me when you can help thousands?" Everett said. His voice held a strong resignation that had emerged from his initial depression.

"As if one cure precludes another!" Andrea scowled. "Why do we pit the two types of research against each other, as if they were our only two

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choices? The government spends more money maintaining *flower gardens* around monuments than they do on Heidegger's research—why does one bit of science have to siphon money from other sciences, rather than something else? Everything isn't equal." She looked down, though she knew he couldn't see her face anyway. "Besides, if I find something I'll just tell Alternitech that I found it by accident while doing other research. They can't prove otherwise."

Everett smiled, like a parent watching a child deliver promises with false bravado, then he reached for his sandwich. She watched him squint until he found it.

She swallowed a large bite. "We should get back. I can go out hunting at least two more times today."

Everett's face was a plain mask of disappointment, but he said nothing.

In her long search, most of the alternate universes appeared identical. Digging into the medical research libraries, sometimes she discovered even less progress on Heidegger's Syndrome, or none at all. Twice, she found minimal successes beyond her own timeline, but nothing worth bringing back. With a run of unlikely bad luck such as Stendahl's, it seemed obvious that in some other timeline he would have received his rhesus monkeys, his grad student would have stayed an extra six months.

Throughout her search, she also had to find enough other tidbits to keep Alternitech happy. They had told her not to waste time hunting a cure for an orphan disease, yet they were delighted when she found a way to artificially change eye color from blue to brown and back again. Plenty of cosmetic and commercial applications, they said. Their priorities made her sick.

She had lost count of the timelines by now. On each mission, Andrea went directly to a university's medical library and buried herself in Stendahl's publications, checking to see if he had anything new to offer. This time, according to the library, Stendahl had completed his experiments, but his crucial summary papers were "in press," which meant they were not yet published and would be available only in his office.

Andrea hurried along the dim corridor. So far, every timeline had the same chaotic construction in the west wing of the building. Perhaps chaos itself was the only constant among the timelines. Yellow barrier tape blocked off corridors, light fixtures lay on the floor, the sounds of hammers and power saws echoed in the halls. Andrea passed a pile of newly-cut boards, ducked under a scaffold holding drip-splotched cans of paint. She hadn't yet been able to determine if they were building something up or tearing something down.

Stendahl's door was closed. Taped to the wall beside his office hung a handwritten note giving an address to send Get Well cards. Under that, she read a newspaper clipping that described how Benjamin Stendahl had broken his leg after stumbling in a construction area, and that he was not expected to return to teach

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classes for the remainder of the semester.

Stendahl's door would be locked, but all cure hunters kept lock-picking tools in their packs. If this timeline had some crucial information for Everett, she would take whatever measures were necessary. As she worked at fumbling the slim tools into the door's keyslot, construction noises drowned out the sounds of her hidden efforts. But she kept looking over her shoulder. She was not good at this.

Wrapping her sweaty palm around the knob, Andrea finally opened the door. She ducked inside and closed it behind her, flicking the light switch.

Stendahl's abandoned office smelled oppressive and long-empty, though he had been in the hospital for only a week. She switched on the computer, letting it boot up as she scanned the bookshelves. She did not have much time to find what she needed, and Stendahl's cluttered organization made the task more difficult.

She saw the title on the fresh manuscript lying on top of one pile, then found a folder filled with memos, his hand-jotted records of the experiments, raw data. She flipped through the pages. At the end of his summary Stendahl even suggested a few treatment methods. "Yes!" she said.

She glanced at her wristwatch, trying to determine how soon the Alternitech portal would come back for her. She could use her camera to photograph each page of the hardcopy summary report, but this was raw data—files and files of it—experimental records, suggested follow-up tests. It would be laborious and time-consuming to copy all of it. More time than she had. But she could store everything onto one of her diskettes—if she could find the right files on Stendahl's computer.

Andrea went to the computer, glancing at the menu and searching for Heidegger files. As she feared, Stendahl had imposed little organization on his filing system. Some of the file names contained the word "Heidegger," but when she called them up, they were mere memos requesting supplies. Stendahl had named seven of the files REPORT1, REPORT2 . . . each taking up significant disk space. She checked the file-creation dates, then called up the most recent, but it had nothing to do with Heidegger research.

Out in the hallway, the construction workers used something that sounded like a jackhammer on the walls. Andrea tried to ignore the racket and concentrate on her work.

Finally, when she pulled up REPORT5, the words described all his tests, all his results, all his suggestions. Jackpot!

Excitement and anxiety growing within her, Andrea checked her watch again. She unzipped her pack and pulled out the various blank diskettes from her own universe. She pulled a disk out of its plastic sleeve and tried to slide it into the drive.

It was an eighth of an inch too wide. But she had other formats, other sizes to accommodate slight differences among the timelines. She tried another from her stack.

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She finally found a diskette that fit. Stendahl's drive began formatting it. Alternitech experts had always been able to decode her diskettes, no matter how subtly different their computers might be. Of course, the techs might not help if she brought back something she had been instructed not to look for. She might have to call in all of the favors she had earned in her years of working for Alternitech.

The disk finished formatting. It would take a few moments to copy the files. She didn't have much time; the portal would come back for her soon.

At the far end of the hall, one of the construction workers cursed as the jackhammer noise changed with an abrupt clank.

All the lights in the building went out.

Stendahl's office filled with blackness. The computer died. Andrea's hopes died with it.

By flashlight, she photographed as many pages of the draft manuscripts as she could. Working backward, Andrea snapped each image of conclusions, then the experimental method, and finally began plowing through all the raw data. She stared at her chronometer, watching the time tick down.

Each time Alternitech's machinery cast her across the parallel universes at random, like a fishhook in the water. Now that she had found a timeline that offered hope for a Heidegger's cure, chances were very slim that she would ever find herself back *here*. Frantic, she kept photographing the data, hoping that her flashlight provided enough illumination for the pictures to turn out.

Finally, when she could not wait a second longer, Andrea clicked one more photograph, then ran out of Stendahl's office, leaving the papers scattered all around. Glowing green EXIT signs shone in the darkness. She heard voices calling, complaining about the power outage. By the bobbing light in her hand, Andrea ran through the halls, dodging construction barricades. She had to get back to the portal.

A gruff voice yelled for her to bring the flashlight over so they could find the circuit panel, but she ignored it. She nearly tripped over a pile of pipes against one wall, but she caught her balance. Reaching the secluded stairwell, Andrea stumbled into the shadows just as the Alternitech portal slashed through the air.

Clutching her precious data, Andrea fell across the sea of timelines.

"Well," Stendahl said, raising his bushy eyebrows, "that's the good news." Andrea suddenly felt her stomach turn into ice.

He folded his hands on his desk and leaned toward her. Around him, she could see photocopies of the article and notes she had taken from the alternate universe. Stendahl had studied them, marked them with a red pen. She spotted several pieces of data circled, a few with exclamation points beside them. Andrea feared that she had not managed to include the *one page* that contained crucial measurements or descriptions of the

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one round of tests that would have allowed Stendahl to create a treatment for Heidegger's. It would all be lost.

Alternitech management had not been pleased with Andrea when she had returned with information on Heidegger's Syndrome, information she had been specifically told not to seek out. They had suspended her, until they received a phone call from an angry senator whose daughter was even now being treated for multiple sclerosis—using the prescription Andrea had brought back. The phone call seemed like a miracle cure to her situation.

Now, Everett was the only one who had something to lose.

Andrea met Dr. Stendahl's gaze. "What is it?" she said, her voice hoarse. "What's the bad news?"

"I've confirmed—er, I mean I *agree* with my own conclusions." He forced a wry smile. "This research does indeed suggest a treatment regimen that could offer hope for people diagnosed with Heidegger's Syndrome. But—"

Andrea flinched, but she didn't dare say anything else.

Stendahl looked away. "As with so many other ailments, beginning the treatment at the onset of the disease holds the key to the cure. If we could have started this right when your husband's eyesight was affected, when the disease was still confined to the optic nerve, we might have had a chance. He could have suffered a loss of eyesight, but the disease itself would be eradicated."

His feathery eyebrows rode up his forehead. "In your husband's case, the disease has already migrated to the medulla oblongata. The damage is already being done to the crucial nerves that govern involuntary functions such as heartbeat and respiration. This treatment itself purges the disease, but at the cost of destroying the nerves that are affected—somewhat like amputation."

Andrea took a long, shuddering breath.

"Obviously, we can't do that in Everett's case. Not anymore," she felt a dry whispering sound in her ear, as of her own ragged hope draining away.

Stendahl was lousy at sounding optimistic. "From now on, anyone else diagnosed with Heidegger's will have a chance. You've saved those eight people a year you were so concerned about. No one else would have funded my research. You have that to show for your efforts, if nothing else."

Andrea found she couldn't listen any more.

Mist generators sent a cool fog toward the ceiling of the room, making the bright green and red laser beams stand out. Everett had been furiously working on another sculpture, fine-tuning it and trying to finish while he could still function. He had cranked up the laser intensity to the maximum safe level, just so he could discern the beams with his failing eyesight.

With the rest of the house darkened and only a few stars visible out the window, Andrea lay next to him on the floor, looking up at the laser tracery.

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Everett spoke in the darkness. "There was a poet during the Boer War who said to live every day as if it were your last, for one day you're sure to be right."

"When did you start reading poetry?" Andrea said, trying to change the subject.

"I've had a lot of time to do things while you were off at Alternitech." He sighed. "But I'm glad you found the cure anyway."

"You're still going to die!" Andrea snapped. Her failure seemed like fluttering wings around her head.

"We're all going to die," he countered. "But you've given a longer life to the other people who get the same stupid disease I did." He took a long breath. "I came to terms with this illness a long time ago. It's *you* who need to accept it."

"I had to try," she mumbled. But she began to wonder if her obsession to find a cure, her need not to fail at the task she had set for herself, was actually more for herself instead of Everett.

"I know you did," he said. "Thank you for trying, Andrea. But all those days you were gone hunting . . . I would rather have gone to the mountains with you, done a few more bed and breakfasts up the coast." Everett's words stung.

"There are plenty of other versions of *me* in other universes who *will* have a long and happy life with you. In our timeline, I had an unlucky break. I got an incurable disease that nobody's ever heard of. It just doesn't happen in *this* timeline, with this Everett and this Andrea."

He sat up abruptly. "We've got money saved, so why don't we spend it? Besides, you'll be getting a big life insurance check from me before long."

Andrea winced, but he gripped her hand. She thought of the hours she had lost in her desperate hunt. "I suppose I could take a leave of absence from Alternitech," she said haltingly, "especially now. It would give them time to cool off." She flashed him a smile that was at first forced, but gradually grew sincere as she thought of the things they could do together, now that all the restraints had been stripped away.

"All right," she said. "Let's go be alive as long as we can." ■

Note: This story was inspired by the plight of science fiction author George Alec Effinger, and his recurring medical problems that insurance companies refuse to treat. Kevin J. Anderson will be donating his payment for the story to the George Alec Effinger Medical Fund, % NFSA, P.O. Box 500, Bridge Station, Niagara Falls, NY 14305.

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BIOLOG Jay Kay Klein

Kooistra is a two-syllable word (Coy-struh). Add syllables for Jeffery D. and you have a Frisian-descended *Analog* author writing in English, but with a sense of the ancient language now considered the one most closely related to English. Jeff admits also to holding traits still associated with those coming from the bits of land and islands making up that part of the Netherlands called Friesland: stubbornness and independence.

Like nearly every science fiction writer, he loves science, but has such broad interests that he has scattered his attention everywhere. He thinks that learning is what he does best. With formal degrees in physics, psychology, and teaching, plus a minor in English, Jeff has also read widely in history, theology, philosophy, and anything else you might come across in a well-stocked library.

Photo: Randy Mulder and Wes Derries

Jeffery D. Kooistra

With a conservative Calvinist background, his mindset is systematic and rational, but infused with poetic love of language. He thinks he was predestined to be a writer. First, though, he taught high school math and physics not far from a Navajo reservation in New Mexico. Growing up with Dutch descendants in Grand Rapids, MI, he was surprised to find Indian and Anglo kids shared far more similarities than differences.

Jeff started writing in junior high, right after picking up his first *Analog*, September, 1973. It took some years, but he eventually worked out his own method of writing. Several times a week, he sits down at a word processor, and bangs off 300-400 words. After a break reading and listening to good music, he goes back for another session or two, sometimes managing 1200 words in a day.

He typically starts with a theme or a core idea, and what happens as it unfolds is a surprise. Though some writers swear by word processors for their ability to aid with lots and lots of rewriting, Jeff does little of that. After setting a first draft aside for a month, he finds all that's needed is to

(Continued on page 110)

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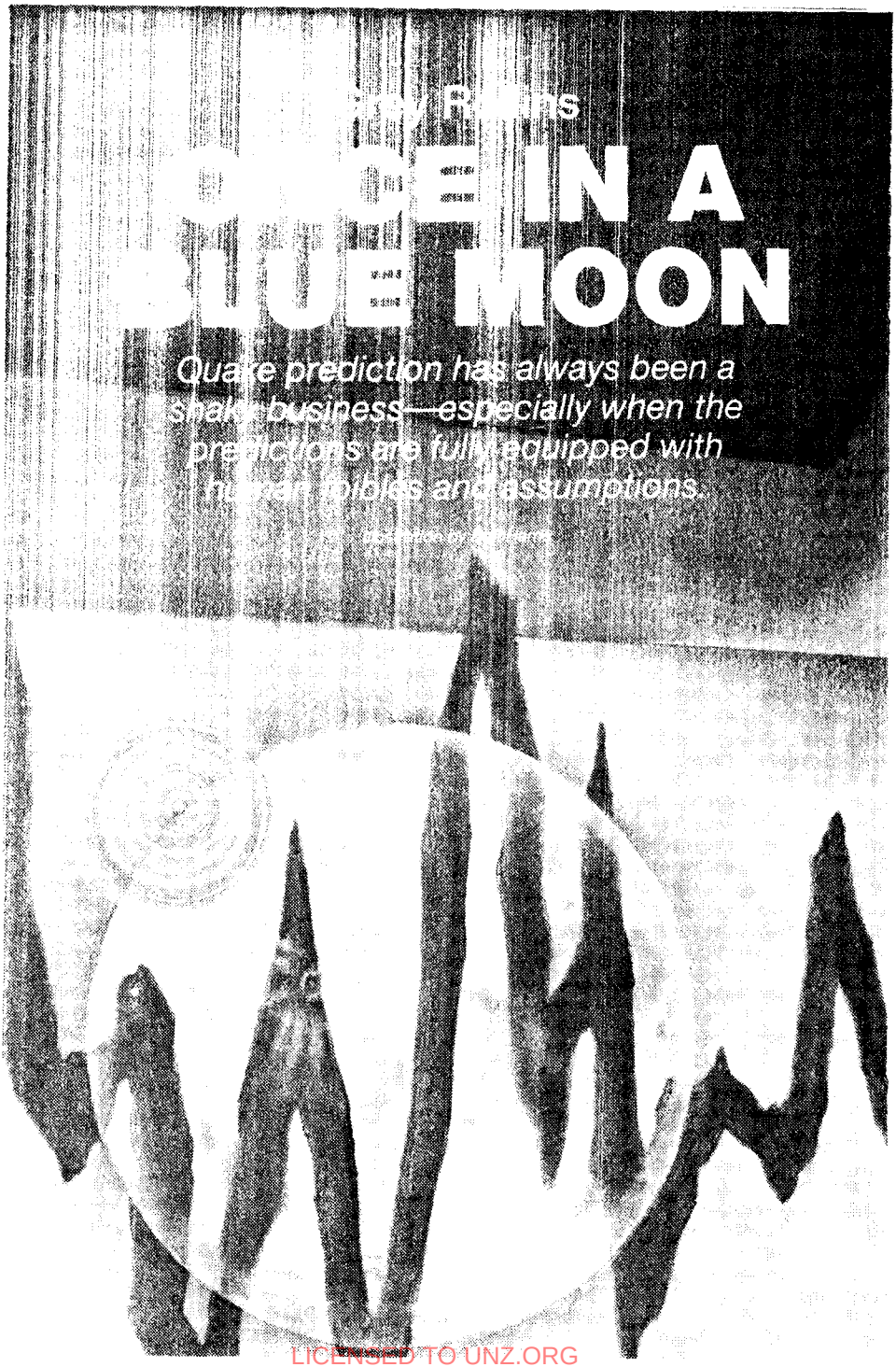
Tony Rothman
ONCE IN A
BLUE MOON
Quake prediction has always been a shaky business—especially when the predictions are fully equipped with human foibles and assumptions.

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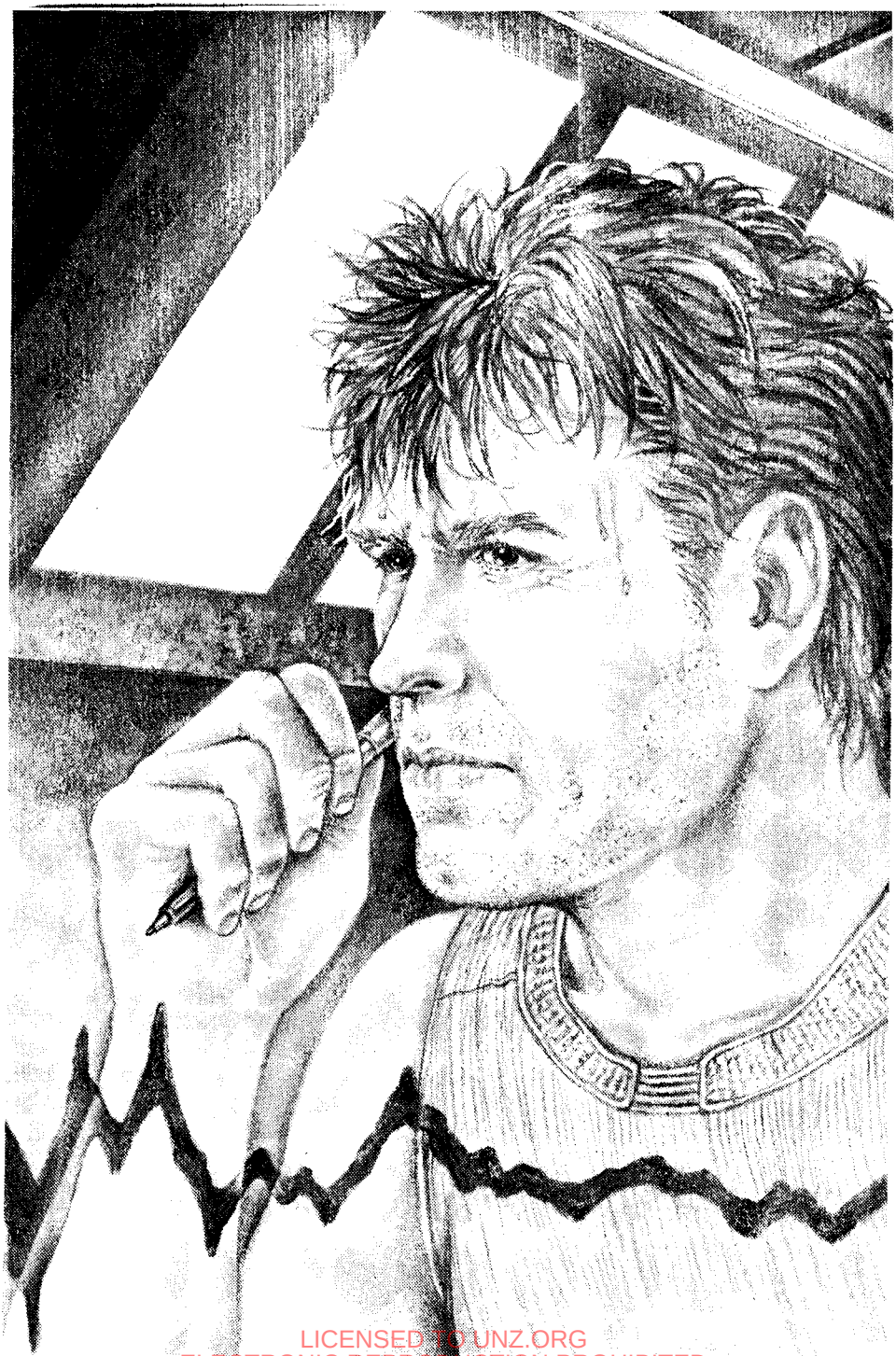

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Originally, the Toyota PackRat had been a darker blue, but Luna lacked enough atmosphere to block the relentless solar glare, and it had faded to the color of well-worn jeans. It clawed its way to the top of the ridge rimming the small crater, skidding sideways on scree for a heart-stopping moment before regaining traction.

The Sun was setting behind it; one moment a harsh disk straddling a peak behind the Toyota, the next it disappeared completely as the PackRat crested the rim of the crater and dropped into the shadowed interior. There was nothing but starlight within.

Inside the cab of the boxy Toyota the driver flicked the switch to turn on the headlights. Instantly, the rocks in the path sprang to attention, casting sharp-edged shadows.

Ahead was a conical pit in the pulverized rock dust which covered the crater floor. The dust sloped down at a low angle to a bare circular area roughly two meters in diameter. Evan Barstow, the driver, stopped the van well short of the edge of the depression. He suited up and made his way down into the pit.

In the center of the bare rock, bolted to fixtures fired directly into the rock, was a seismometer. The data transmitter had failed, necessitating the retrieval of the recorder's solid state backup memory. Barstow replaced the malfunctioning transmitter unit and tested it to make sure that it was working properly before returning to the PackRat.

Barstow placed one foot on the first rung, preparatory to climbing into the tiny air lock, but stopped. He took a deep breath, much the way a man would who was smelling the air outdoors, and looked around. He was enjoying the sensation of being out of the cramped temporary quarters. With an effort, he forced himself to take the step up into the air lock. There was a limit as to how long he could stay out on the surface. Although his suit was good for hours more, the very knowledge of the limit galled him.

Once out of his suit, he tossed the memory module from the seismometer into the empty passenger seat. Slowly, he drove back across the crater floor, then up the sloping crater wall, wincing as he crossed back out into the full fury of the setting Sun.

The drive back to the hut he shared with six other scientists took nearly two hours. When he was still thirty minutes out, the van's computer informed him that Jane Wills was trying to reach him. "OK. Let her in," he told the computer.

"Evan?"

"Evan's not here," he told the small image above the dash. "I'm the man in the Moon."

Her mouth twisted. "You're short on sleep. Your jokes always fall flat when you're tired."

"Won't argue the point. Why don't you folks all decide to do extensive field work on Farside just as soon as I get back? I'd like to have some peace and quiet."

"It wouldn't help," she told him.

"Why?"

"Because you're the seismologist

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and you're going to be busy for a while."

"Quake?"

She nodded. "Estimated at four," she said, indicating the strength on the Richter scale.

He shrugged. "Strong for Luna, but not so bad, overall."

"Normally it wouldn't be."

His eyes narrowed. "Uh oh. Where was it?"

"Near New London. It hit a short while after you left. The trace from your seismometer should allow a better triangulation."

"Then I'd better hurry on in."

"You do that," she said, and broke the connection.

The computer at the hut read the information from the memory unit in less than a second. Two more seconds elapsed before it pronounced its judgment.

"The epicenter was New London."

"We know that," Jane said. "We need to know how close to New London it was."

"The epicenter was New London," the computer repeated.

"The city itself?" Jane demanded.

"The epicenter was New London," the computer insisted.

Barstow frowned. "How deep?"

"From the data I have, the hypocenter seems to have been nearly at the surface."

Barstow's frown deepened into a scowl. "Like maybe within a couple hundred meters of the surface?"

There was an almost imperceptible pause. "Would 93 percent probability suit you? If you can get me more data, I'd be happy to firm that estimate up for you. I can't number crunch without more numbers to crunch."

Barstow turned to Jane, and Sven Anderssen, the only other scientist present at the moment. "I don't like the sound of this. What if their tunneling has changed the stress load on a fault?"

Anderssen asked, "Is there a known fault anywhere near New London?"

Barstow shook his head. "Not that I've heard of, but I guess we'll have to put one on the map."

"So now the question becomes whether this relieved the stress," Anderssen said.

Barstow shrugged. "There are two theories—one says that a quake relieves stress and that the fault should be more stable after the quake. The other way to look at it is that the first quake limbers things up and that another part of the fault will find it easier to release."

"So there could be another quake?" Jane asked.

"It's possible. Quake prediction is still on par with reading tea leaves, as far as accuracy is concerned."

"There are fifty thousand people in New London," she said worriedly. "What happens if a bigger quake hits?"

Barstow began his answer indirectly. "I can show you pictures made after quakes on Earth where the ground slippage was measured in meters. A strong quake would collapse some of the corridors and tunnels. If anyone should survive, there wouldn't be any practical way to get them out. Even if you were able to

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move enough rock to get to them, you wouldn't be able to guarantee that you could maintain air pressure in the tunnels during the rescue effort."

"So we'd lose *everyone?*"

He took a deep breath. "You might save a few—if they were lucky enough to be on the surface when it happened and had enough air to hang on until help arrived. As far as the people underground . . . I'd say it'd be a case of holding a mass memorial service over what used to be New London."

The quickest way for Evan Barstow to get to New London was for Andersen to drive him into Besselton in the PackRat. From there, he caught a ballistic shuttle. As the most experienced specialist in seismology on Luna, he had been asked by Commissioner Hammond Kent to analyze the likelihood of another quake.

If he decided that another quake, one of sufficient strength to damage the structural integrity of the city, was possible, one of the most difficult evacuations in modern history would be attempted as the citizens of New London moved out—leaving a ghost city behind. The logistics of absorbing the population of New London into Crisium and Besselton were being examined, but the preliminary estimates were that only a third of the people could be taken in before the existing utilities, particularly air regeneration, were overloaded. A small fraction could be farmed out to outlying communities, but the overall prospects were grim.

The shuttle landed just after ten, local time. As Barstow passed the ticket counter he was intercepted by an astoundingly beautiful woman with a pronounced Southern accent.

"Are you Evan Barstow?" she asked.

He nodded, bemused.

"My name is Desiree Stuart-Gwaltney. If you'll come with me, I'll take you to Hammond's office."

"That would be Commissioner Hammond Kent?" he asked.

She laughed quietly. "Oh, sorry . . . yes. I keep forgetting to be formal about him. His secretary is absolutely tied in knots trying to handle preparations for another quake, so he asked if I could reel you in."

"Somehow, I gather that you're not attached to his office," he observed.

She wrinkled her nose in disgust. "Not at all. The decor is absolutely awful. The man himself, however, I'm very much attached to—happen to think the Sun rises and sets on him, as a matter of fact."

His puzzled look persisted.

"I'm his lover. I'm over from Crisium to visit. Suddenly the Earth moves. . . ." She cocked an eye at him. "OK, bad joke. At any rate the quakes started, and—"

"Quakes, plural? You've had another one?"

She nodded. "Not quite as strong as the first, but enough to worry people. Everybody was fairly calm after the first one, but as soon as the second one hit, they started running in circles, and Hammond needed someone to run errands because his secretary was swamped. I volunteered. So here I am."

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He nodded. "I think I've got the picture now."

"Naturally, we're hoping that you'll conduct some sort of arcane ritual to appease the gods—"

He shook his head ruefully. "I wish it were that easy. Over the years we've accidentally triggered a couple of quakes, but we've never found a way to put the genie back in the bottle."

She made a moue. "Too bad. Well, if nothing else, this will give you a chance to stretch out a bit. I understand that you've been living in temporary quarters for a while."

He grimaced. "Is that a subtle way of telling me that I need a shower?"

She laughed. "Heavens, no. You smell fine. It's just that they had a display of the various sizes of bubbles in the Atrium once, and even the largest one gave me claustrophobia. God knows how people manage in the smaller ones, unless they're *very* good friends."

"Honestly, I feel more cramped in here than I do in the bubble. I usually set the walls in the hut so I can see out. I know the wall's there, but I don't feel cooped up, since I can see several kilometers in any direction. In here, I see solid walls everywhere I look, and they're *close*."

"Here, let's take this ramp," Desiree suggested. "Unless you'd rather see the Atrium?"

He shook his head. "I've seen it already. I was here last April, I think it was. Besides, with my luck, the next quake would hit while I was standing around gawking like a tourist."

"Hammond tells me that the skylight in the Atrium is the city's weakest point. Aside from the locks, it's the only point at which the city is exposed directly to vacuum." She shook her head. "I'd hate to think of what would happen if the dome broke."

"I'm not a structural engineer, but I imagine that the dome itself would remain intact. Presumably the frame would distort and the seals would start to leak before the plastic actually gave up the ghost."

She shuddered. "Poor choice of words, Evan. Let's not tempt fate like that."

Commissioner Hammond Kent was a tall man with a handsome angular face that made him look more like the leading man in a vid than a politician. He came around his desk and shook Evan Barstow's hand warmly, but his expression was grave. "Welcome to New London, Mr. Barstow. I'm sorry it couldn't be under better circumstances."

"I'm just hoping that I can be of service to you."

Kent adopted a casual pose, leaning back against the front edge of his desk. "I understand that earthquake . . . I suppose I should say selenoquake prediction is an inexact science, but you must understand my position. I'm responsible, directly or indirectly, for the safety and well-being of the people in New London. I would be remiss in my duties if I didn't at least *try* to assess the danger."

Barstow nodded. "I understand. There are several tasks ahead. One is

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to locate the fault. Another is to try to identify the source of the strain on the fault. Quakes on Earth—we quit trying to work the name of the planet into the word when someone finally realized that we'd have a different term for every planet and moon in the Solar System—are generally a side effect of plate tectonics. When one plate is subducted—shoved underneath another one—there's a certain amount of wear and tear." He grinned mirthlessly. "Wear is no problem . . . it's the tear that you have to worry about."

Kent frowned. "But that's not the case here on Luna."

"Correct. Without a significant sized molten interior, there's nothing for plates to float on, hence no friction as they rub together. On average, Luna is a million times less active than Earth. Here, most of the quakes are caused by unresolved stresses from earlier stages of Luna's formation and, of course, Earth itself."

Desiree cocked her head. "Earth causes quakes here?"

"Earth represents a great deal of mass, meaning gravitational pull, as far as we're concerned. Over time, small changes in orbit cause stress to build. Once it reaches a critical stage, it releases and we have a quake. In fact, most of our quakes occur when Luna is at perigee."

Kent nodded to himself. "OK, so if this were a murder case, we'd have the weapon, which is the fault. We would also have opportunity, which is stress on the fault. That leaves me to ask about motive—why did the fault move? What triggered it?"

"I'd like to think that we'll know more about that when we get a better idea of how the fault is positioned. One of the most likely culprits is tunneling."

Kent's eyes narrowed. "We do that constantly these days. Our population has been increasing rapidly over the last five years or so. I'll put an immediate moratorium on tunneling. We'll double up in our existing space, if necessary. Is there anything else I can do?"

"I'll need a map of the city. A good one."

"No problem. Anything else?"

"Not really."

Kent breathed deeply. "I don't suppose it will come as any great surprise to you that I want to know whether we will have a third quake. And if so, how strong?"

"Under ordinary circumstances, Luna is a pretty quiet place. A quake near enough to one of our cities to cause a problem would happen only rarely—once in a blue moon, you might say. To have had two in quick succession bothers me, so I'll have to defer answers until I've had a chance to study things a bit."

"In the meantime, we'll all wish you luck and keep one of Desiree's Second Skin suits handy," Kent said.

Barstow snapped his fingers as he looked back to Desiree. "I knew your name sounded familiar . . . you're the one who came up with the fabric those suits are made out of."

She smiled. "I must admit that business has been *very* good since the first quake. We're having trouble getting enough Second Skin suits over

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here from Crisium to meet the demand."

"No offense, but I hope the quakes stop."

She nodded earnestly. "Oh, I agree completely. If we get hit by a really serious quake, my suits aren't going to amount to a hill of beans when it comes to keeping people alive. They're only designed to give them a few minutes leeway, not provide hours of life support. And they certainly weren't designed to turn falling rock."

One blessing that Evan Barstow hadn't counted on was a complete set of measurements left from when the New London site had been surveyed prior to burrowing into the ground to begin the city. Taken using laser transits, the figures provided precise distances between different landmarks on the surface above the city.

After locating the original survey points—a task facilitated by the fact that in several cases the boot prints of the first survey team were clear enough to be read in the surface dust—Barstow took new measurements in an effort to ascertain whether the fault had displaced any surface features. Within the limits of the earlier survey he was unable to find any measurements which had changed. What he needed now were ongoing readings from fixed instruments, accurate down to fractions of millimeters.

He set out laser transits in a hexagonal grid large enough to take in the entire city. In addition, he placed three seismometers. Once analyzed, the data from the instruments would allow him to pinpoint the hypocenter of any new quakes as well as see if there was an identifiable fault which extended to the surface.

Since he had no office, he fed the data through the city's communications network to his room at the Hilton. After that, it was merely a matter of loading the appropriate software into the room's computer terminal.

By the time the instruments had been set out and the software loaded, it was well past midnight, local time. Barstow rubbed his eyes and pushed back his seat from the terminal.

Throughout the night the instruments would register small quakes, many of them so tiny that the vibrations were well below the threshold of human perception. Enough of those would give him a fair picture of any faults in the area without being severe enough to cause problems.

Rubbing the stubble on his chin, he headed for the shower. It was quite small, but it was admittedly better than the pulsed water jet he had been using in the tent. Better still, the water was gloriously hot.

Within minutes after getting out of the shower he was in bed. As he drifted off to sleep he made a mental note to check the monitoring program first thing in the morning.

He awoke in the absolute darkness perceived only by those living in caves. It was utterly silent. The effect was one step short of a sensory deprivation tank. He sat bolt upright, panicked, suddenly convinced that a quake had hit and knocked out all

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power.

"Computer?"

"Yes, sir?"

"Did we just have a quake?"

"No, sir."

He sat, mulling this over for a few moments. "OK. What time is it?"

"Four-thirteen, sir."

"So I woke up for nothing?"

"I don't understand, sir."

He waved his hand in mild frustration. "Never mind. I'm going back to sleep."

"Yes, sir."

But sleep refused to come. He tossed and turned and fluffed his pillow, but to no avail. It was just too quiet. After living in an area not much larger than the tunnel with six other people, he was accustomed to the sound of their breathing and their small motions as they slept.

He stared towards the ceiling over his head, invisible in the darkness. In the plastic habitat, he would have been able to see outside—stars during the lunar night; the surrounding terrain if the Sun was up.

Here, he could sense the imponderable weight of rock hanging over his head. If a strong quake hit, he would have just enough time to realize what was happening before the ceiling collapsed and crushed him.

Sweat began to bead on his forehead. His palms grew damp. His breath became raspy.

He forced himself to breathe deeply and slowly in an effort to calm down. Having a panic attack wouldn't help anything. He would not fall prey to illusory fears.

But there was nothing illusory about the possibility of a quake.

The next morning he arrived at Commissioner Hammond Kent's office ten minutes late. His face was haggard and there were circles under his eyes.

"Did you get your instrumentation set up?" the commissioner asked.

Barstow nodded. "It's all ready. The ironic part is that we have to hope that nothing happens, since we don't want a quake, but if nothing happens then I won't have any data to use to assess the likelihood of another quake."

Kent flashed him a quick grin. "Well, then all we need to do is keep you here as a sort of magic talisman. A practical application of the old saying that a watched pot never boils."

"Maybe it's working. Clearly, we didn't have any big quakes during the night. I had meant to check and see if there had been any foreshocks, but didn't have time this morning. I'll do that as soon as I get back to my room."

Kent shrugged. "I won't keep you. I just wanted a progress report." As he ushered Barstow out the portal, he asked, "Are you feeling well?"

Barstow said, "A little tired, I guess. I'll be all right."

Kent nodded in understanding. "A change in environment can make it hard to sleep. I have trouble every time I go to Crisium or Besselton."

Barstow smiled, grateful for the excuse. "That's it exactly, I'm sure."

But as he walked down the corridor to the slidewalk, he kept one wary eye on the ceiling.

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* * *

All the way back to his room at the Hilton, Barstow fought himself. Simply a case of nerves brought on by fatigue, he decided. No doubt, he would sleep better tonight.

It took only moments to bring the analysis software online. Seconds later he gasped as the display projected a curve into the air before him based on well over *nine hundred* shocks, ranging from microquakes up through one at 2.1 on the Richter scale—still too weak to be felt. All in less than twelve hours.

His professional curiosity was at war with his personal fears. What in hell could cause so many foreshocks in such a short period of time? Such a level of activity indicated a tremendous amount of stress being released—or about to be released.

The shape of the curve bothered him. The quakes should be following either of two patterns: a random distribution which could be interpreted as background noise, or a simple curve, usually roughly exponential. A falling curve would be normal aftermath for a larger quake. If the curve was rising, it would indicate the possibility of another large quake.

Instead, plotted against time, the number of quakes increased from the time the system had come online until peaking just before six that morning. Then they had declined until reaching a plateau which was still in effect.

Barstow's first thought was that the equipment was at fault. He ran it through a self-test program. Everything checked out perfectly.

That left him facing the very real possibility that he would have to come up with an explanation to fit such a bizarre distribution curve.

In the meantime, he needed to let Commissioner Kent know that there was still plenty of unreleased energy out in the rocks surrounding the city.

Hammond Kent sat staring thoughtfully at the space where Evan Barstow's projected face had been moments before. His eyes were narrowed as he weighed the possibilities. Finally, he reached out and tapped the button that connected him to his home tunnel.

"Desiree?" he called.

"Coming . . ." She popped around the corner from the bedroom, wearing only an unfastened bathrobe.

His eyes widened. "Good heavens! What if I'd had someone in here with me?"

She raised one eyebrow. "Afraid I'd give someone the wrong idea? Surely everybody knows that I'm staying here by now. What do they think we do at night . . . play poker?"

He grinned, one eyebrow raised. "Strip poker, from the looks of things. And it looks as though I'm winning."

She blinked. "Who says it's you I'm playing?" She watched his jaw drop before relenting. "It's OK, darling. I was just getting ready to take a shower when you called. We're due to have lunch together in another forty minutes, remember?"

He grunted. "Yes, I remember, but I wanted your input on something."

Suddenly serious, she belted the robe about her waist and sat. "Cer-

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tainly. What's wrong?"

"You remember the fellow I asked you to meet at the 'port yesterday, don't you?"

She nodded. "Evan Barstow, wasn't it? Is something wrong?"

He made an equivocal motion with his hand. "I'm not sure. If I didn't know better, I'd say he's coming down with a bad case of tunnel fever."

"Claustrophobia."

"Exactly."

"What makes you think so? And other than the fact that he'll be uncomfortable while he's here, does it matter?"

"To answer your first question, I just got through talking to him. He called to tell me that he's getting some very unusual data from his instruments. Apparently there's a great deal of small scale seismic activity. My point is that while I was talking to him, he kept glancing at the ceiling. Add to that a pale complexion, nervous jerky movements, and heavy perspiration and you've got classic symptoms. Oh, and he clearly had not slept well, either."

She looked thoughtful for a moment. "Hmmm, classic symptoms, yes, but things like that can easily be taken out of context. For all we know, he could be shy—nervous about talking to a lunar commissioner. We don't know him, so there's no way to tell."

"Did you notice anything yesterday?"

"No, not really. Oh . . . he mentioned that he liked being in the habitat better than being in the city, but that's hardly conclusive. I don't remember that he was looking at the ceiling."

Kent chuckled dryly. "On the other hand, if you flashed him the way you just did me, it would be all he could do to look at the ceiling, or anything else for that matter."

"Shameless flattery will get you everywhere, Hammond Kent." She tilted her head. "You still haven't answered my second question. Does it really matter?"

"Normally, no. But under the circumstances, if he's under stress —wanting nothing more than to get outside—then he might be prone to interpret the data in such a way as to recommend an evacuation when one wasn't called for."

"So you think he may not be objective."

"That's about the size of it. Obviously, if it's necessary, I want to evacuate as soon as possible. On the other hand, an unnecessary evacuation would cost millions and disrupt the lives of every person on Luna. Furthermore, it would cost lives as well. Any large scale movement of people inevitably entails some loss of life."

"It all boils down to Evan Barstow's mental state. And you believe he may be unstable." She thought for a moment. "Does he have any friends here? Someone who could help us evaluate him? For that matter, a friendly face might help stabilize him."

Kent nodded slowly. "Good thinking, Desiree. I'll see what I can find out."

"Let me think on it while I'm in the

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shower. I'll see you in a few minutes. We can talk more about it then."

"Thanks." He broke the connection, then sat back. So many things to worry about . . . the last thing he had expected to have to deal with was the sanity of the seismologist.

Evan Barstow sat in the seat before the terminal in his hotel room, anxiously noting each new tremor as it appeared on the three-dimensional representation of the terrain surrounding New London. The dots were color coded for strength on the Richter scale.

On another display was the graph of shocks versus time. If there was going to be another large quake, this readout would rise rapidly just before the quake hit.

So far, the foreshocks he had detected were massed almost exclusively on the northeast side of the city. He suspected that two linear features were tunnels; that the rock was still adjusting to their presence. That should be easy to verify. The map he was using to plot the foreshocks only showed the Lunar surface—he needed the exact layout of the tunnels that burrowed beneath the surface.

The other groups of dots were potential, call them probable, faults. It was a continuing source of frustration that the only reliable way to tell where a fault lay was to wait until it moved. The movement allowed his instruments to detect the point where the fault moved; the hypocenter. A succession of such points allowed the computer to plot the fault, but only those portions which had already moved. Thus, there were gaps in the lines traced on Barstow's displays.

There being little else he could do, Barstow spent the afternoon watching data accumulate. The plateau of foreshock frequency persisted until late afternoon. Slowly at first, the graph of quakes versus time began to drop. At eighteen it was still dropping. Finally, they came to a complete halt just before nineteen. He stood and stretched, listening to joints crack.

He switched off the display and called out, "Computer?"

"Yes, sir?"

"Can you take a room service order?"

"Yes, sir."

After he requested dinner, he stepped into the bathroom to take a quick shower before the food arrived. But when he turned on the water, all he got was a weak stream. He shrugged and stepped in, reasoning that it was still better than what he had been used to in the habitat.

He got out just in time to receive his dinner from the white-jacketed attendant. As he counted out his money, he said, "By the way, you might tell maintenance that the shower in my room has pretty poor water pressure. Last night it was OK, but just now all I could get was a dribble."

The attendant look unsurprised. "It's not your shower that's at fault, sir. The whole city has a problem with water pressure at certain times of day."

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Barstow nodded as he handed over some extra money for a tip. "OK. I guess it's nothing to worry about, then."

After eating, he switched the displays on again. There had been three small tremors spaced over the previous fifteen minutes. That bothered him. They had ceased entirely before he ordered, and now they seemed to be starting up again; by twenty-three there was no longer any question about it.

By now, the three-dimensional graph of the area surrounding the city was liberally peppered with colored dots. One of the two lines he had suspected of being a relatively new corridor had taken on a ghostly tubular cross-section with faintly visible offshoots; almost certainly individual residential tunnels. Even without a map of the city corridors he felt confident that he could rule that one out.

He chuckled when he saw that a tunnel on a higher level across the city had been defined in a similar way, all in the course of a six-minute period. Probably a piece of heavy machinery moving from one place to another, the vibrations as it drove slowly through the corridor had registered on his seismometers. If he waited long enough, he could plot the entire city this way.

He considered stepping down the sensitivity of his seismometers. They were capable of reading nearly molecular-sized movements at full sensitivity, a capability that he rarely used, as any genuine quake activity could easily overload the amplifier sections that fed the signal into the data lines coming to his computer.

He decided to leave things as they were. It might be useful to let the city plot itself. Something might be learned.

The areas he had tagged mentally as faults had been joined by the faintest indications of four others. The newcomers were also clustered to the northeast of the city. Clearly, something of interest was going on there. Mentally, he reviewed what he knew of the city. He was unable to recall any tunnels that extended out far enough to intersect with the area of greatest activity.

Frowning, he said, "Computer?"

"Yes, sir?"

"Commissioner Kent promised me a map of the city, but I don't have that yet. Do you have a general map, maybe one intended for tourists, that would give the layout of at least the major corridors?"

"Yes, sir. I have one sponsored by the Chamber of Commerce that was completed last fall. Will that do?"

"Anything's better than guessing. Can you fit it to the projection I'm using here?" he asked, one finger indicating the three-dimensional representation of the lunar surface and the speckled void beneath it.

"One moment... I will need to change perspective, and... is that what you had in mind, sir?"

"That's great. Change the color to blue. I'm using green as one of the shades for intensity of the quakes." He nodded as the computer made the requested change. "Thanks. That's just right."

Just as he had predicted, tunnels

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lined up on the outlines of two of the sources of microquakes, and on the corridor where the heavy machinery had traveled. Seeing the city arrayed next to the hypothetical faults also gave him a better sense of scale. There were no corridors near the area where the faults were traced.

Barstow sat back and massaged his forehead with his fingertips. Granted, this was only a simplified map, and there were bound to be omissions, but it did seem strange that there were no tunnels near the faults. In fact, they seemed specifically to avoid the area. It was almost as though they knew to avoid the faults . . . but that was impossible, since no one had known that there were faults there until the quakes began.

He made a mental note to remind Commissioner Kent about the more detailed city map in the morning. Perhaps the city engineers could tell him how the existing corridors had managed to avoid the faulted area. Perhaps a different kind of rock which did not tunnel well.

He shook his head and turned back to the other graph. As it was now past midnight, he had a complete twenty-four hours of data. Oddly enough, the trace of quake activity had reached almost exactly the same level as the previous night's data. He scrolled the data back and set the graph to display the entire period.

Up through the night, down in the early morning, rising to a plateau that was maintained throughout most of the day, dipping sharply in the early evening, finally a long, slow rise back to the level of the previous midnight. Something about the pattern seemed entirely too methodical. Familiar, somehow.

He sat watching the graphs for another hour, but after nodding off in his seat, he switched the displays off and crawled into the bed, exhausted.

He fell asleep readily enough, but was haunted by dreams in which the ceiling caved in on him as a quake rolled the rocks in Mare Nectaris like so many marbles in a cupped hand.

Once he snapped awake, drenched with sweat, convinced that he had only seconds left to live, only to find the room safe and secure. He had left a table lamp on so that he would not become disoriented if he awoke suddenly as he had the night before. Blearily, he looked around. Everything looked as it should. Gratefully, he rolled over and went back to sleep.

Again he had a nightmare. In it, the graph of quakes versus time began to move in waves. Ripples spread across the surface of the plot as though it were water. Stronger they became, until the plotted line was undulating like a wave, back and forth within the confines of the axes, threatening to slosh out of its confinement and overwhelm him.

He awoke, screaming, to find that the tunnel was groaning and grumbling. A real quake—not a nightmare. The deep, growling sounds subsided quickly.

Sweat trickled into his eye as he stared at the ceiling, petrified. He wiped at it with the back of his hand.

He was seized with an almost un-

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controllable urge to get *out*. Where did not matter. Anywhere that he could see the sky would do. Anything was better than waiting for the very ceiling to crumble into boulders and kill him as he lay in the bed.

He caught himself whimpering and bit his lip to force himself to stop, drawing blood. Heart racing, he turned sideways in the bed and placed one foot on the floor.

Summoning his courage, he put his other foot on the floor and stood. He looked around. The room looked infuriatingly normal. The quake had not broken anything. Nothing had been knocked to the floor. There was nothing to indicate a quake severe enough to justify as extreme a reaction as he had experienced.

"Sir, you have a call from Commissioner Kent. Do you wish to accept it, or should I tell him to call back later?"

Barstow passed a hand over his face. Talk about the blind leading the blind . . . Kent would want reassurance that his city was not about to be ripped asunder, not knowing that he himself could barely control his own sphincters.

"Answer the call. Uh . . ." He looked down at his rumpled, sweat-soaked undershirt, telling himself that Kent would not look any better. "Visual is OK."

"Yes, sir," the computer responded.

"Evan! Are you all right?" Kent demanded.

He nodded. "Yeah. I think so. I don't mind admitting that it scared me a bit, though."

"What can you tell me?"

"Nothing yet. I haven't had time to look at the graphs. *I* still have power and my computer seems to be functioning—at least it announced your call."

"I've got other things I need to check into. I'm going down to the office. Call me as soon as you have anything. If you can't get through on that line, call my home number and Desiree will answer. She'll get the message to me."

"I understand. I'll do what I can."

"Bye."

"Wait!" Barstow cried, but he was too late, Kent had already broken the connection. He had meant to ask him for the data on the layout of the city, but it could wait.

Seating himself at the terminal, he called up the displays. There it was, textbook perfect. The frequency of foreshocks had peaked sharply just before the quake had hit.

The quake itself had registered at just over four on the Richter scale, almost a carbon copy of the first one. A quake at four was strong enough to rattle dishes, perhaps even cause a few loose things to fall and break, but was not strong enough to cause major structural damage unless there was a weak spot in the roof of a corridor.

He brought up another display and had the computer tune it to a news channel. There was nothing that he could do about it, but some deep-seated part of him demanded to know if anyone had been hurt.

Once again he had to suppress the urge to run, to go topside and sit in the open in his suit until this was all

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over. As he reached for the keyboard, he saw that his hands were shaking.

Swearing quietly, he pushed back his seat and went into the bathroom. Cold water splashed on his face steadied him. He snorted, looking at the sink. At least the water pressure was better than it had been earlier.

Barstow stood braced in the narrow bathroom doorway. The cold metal frame felt solid, strong. It was a reassuring sensation. He felt weakened and ashamed of himself. Fear that he could not control was making a child of him, and his pride was wounded.

This was not the way that a man faced danger—cowering in bed. Other people were depending on him; placing their lives in his hands—the same hands that shook like leaves in the wind.

The face he had seen in the mirror had red-rimmed eyes. He needed those eyes to be clear and focussed if he was to read the graphs accurately. How could he make an accurate assessment of the danger if his eyes, his entire body, betrayed him?

The doorway offered psychological safety. It was common knowledge that a doorway was one of the safest places to be in a quake. Of course, given the realities of life underground on an airless minor planet, any shelter derived from standing in a door was illusory.

But still, it *felt* solid. It seemed to offer haven.

Clenching his teeth, he summoned what was left of his tattered dignity and forced himself to cross the floor to the computer terminal. Each step was mental agony, but he concentrated on placing one foot in front of the other. Six steps to the seat. Slide the seat forward, under the desk, even though it meant that it would take that much longer to get away from the desk in the event of another quake.

Now *concentrate!*

There was a key here. He had only to find it. People were counting on him, not least among them, himself.

The seismometers had pinpointed the quake accurately. It showed as an oval yellow patch on the second largest fault. Anything stronger than a four would have begun shading towards the red end of the spectrum.

He glanced over at the news. So far, no reports of anything more than minor breakage. Good.

There was something spooky about the way that the corridors and tunnels avoided the clustered faults . . . almost as though they knew they were there. Indeed, they began to curve around it to one side, as though to embrace it.

It was too glaring—too obvious to be an accident.

"Computer."

"Yes, sir?"

"Call Kent. If you can't get through to him at his office, call his home tunnel."

"Yes, sir."

In seconds, the call went through. "Yes, Evan? What have you got for me?"

"I need an accurate map of the city. The precise extent of the tunnels and corridors. I've got your standard-issue tourist version, but it raises more

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questions than it answers."

"Oh, sorry, I forgot all about that. I'll get it to you, pronto. In the meantime, what questions do you need answered?"

"Why do all corridors, all levels, stop short on the northeast side of town?"

Kent frowned for a moment, then nodded to himself. "The water reservoir. That's where the reservoir for the city is."

"Reservoir," Barstow muttered, turning to look back at the display of the faults. "OK, thanks," he added distractedly as he broke the connection.

He leaned back, absentmindedly scratching his chin. "Water reservoir . . . water reservoir . . . water reservoir . . . " he mumbled to himself. "Something about water. . . . "

Just then, the computer announced, "Sir, the blueprints of the city just arrived from Commissioner Kent."

"Good. Replace the map from the Chamber of Commerce with the new data."

"Yes, sir."

The display flickered and suddenly there was a large, roughly spherical chamber nestled securely in the center of the active fault zone. Now it made perfect sense as to why the corridors had known to stop when they did.

He stared at the faults. Now it became a question as to which came first—the chicken or the egg? Had the faults existed before the reservoir, or did the blasting cause the faults?

A moment's reflection satisfied Barstow that the faults must have already been there. Short of using a fission or fusion bomb, something the engineers would have been loath to do for fear of contaminating the water, there were no explosives powerful enough to fracture the solid bedrock of the maria to the extent indicated by the display before him.

Somehow there was an interaction between the reservoir and the faults. Was it the weight of the water? There were numerous recorded instances of large manmade lakes on Earth triggering quakes. After the completion of the Hoover Dam over a century before, more than six hundred quakes had been tallied over the next ten years; one had measured five on the Richter scale. After the completion of a dam in India, a quake had killed two hundred people. That one had clocked in at six.

But compared to those bodies of water, the reservoir for New London was tiny—no more than a pond by comparison. Not enough weight, especially considering the lower gravity on Luna. No, it had to be *something else*.

Also, the quakes had only recently started. Had the weight of the water been the trigger, there would have been quakes as soon as the reservoir was filled. He wasn't sure how long the reservoir had been there, but it was at least ten or fifteen years.

It had to do with something that had changed in the last few months. Probably within the past few weeks.

"Computer, get Kent again."

"Yes, sir."

In seconds an image lit to the right

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of the displays. It showed Hammond Kent in profile, talking to a man in his visitor's seat. Kent held up one hand. "Just a moment, Tarver . . . yes, Evan?"

"What's changed about the reservoir?"

Kent frowned. "What's changed? Nothing."

"Something's changed in the last month or two. I don't know what, but there has to be something."

Kent shook his head slightly. "Nothing's changed. As a matter of fact, we're about to begin building a new one. The population has increased to the point where we've outgrown this one. I'm sure you've noticed that your water pressure fluctuates according to the time of day. We've tried increasing the water pressure in the reservoir, but there's a limit as to how much we can do along those lines."

"Damn, I thought I had it," Barstow said, and broke the connection.

Evan Barstow turned back to the displays, then stared in horror. The graph of foreshock frequency was still climbing. It should have been declining after the release of stress in the quake they had just experienced.

Suddenly, he squeezed his eyes shut, trying to remember. In his dream, the graph had been acting like a wave . . . water. The water was related somehow. It—.

His eyes sprang open. He snapped forward in his seat. "Computer!"

"Yes, sir?"

"Get Kent on the line, right now!"

"Yes, sir."

Kent answered. "Yes, Evan?" He sounded somewhat exasperated. "What is it now?"

"Turn on every tap in the city! Do it now! We're about to have another quake and it's the excess water pressure in the reservoir that's doing it!"

"*What?*"

"I don't have time to explain. We've got to reduce the pressure in the reservoir or we're going to have another quake."

"When?"

"Now! Wake people up. Get water flowing, but *whatever you do, don't pump it back into the reservoir!*"

"You realize that you've made life difficult for us, don't you?" Hammond Kent asked. It was late the next day, and he, Desiree, and Barstow sat in the commissioner's office.

Evan Barstow grinned. "A major quake would have been an even bigger inconvenience," he pointed out.

"But where am I supposed to put all the water?"

"You said that you were getting ready to build a new reservoir. I'd say that it was time to get started."

"But what will we do in the meantime?"

"Keep water in jugs. Fill bathtubs. I don't know. I'm just the seismologist. You wanted me to look at the quake situation. I did. Against all odds, I was able to tell you a way to make them stop. I can't make you follow my advice, but do me a favor and let me get out of the city before you run up the pressure in the reservoir again. I don't want to be here when the roof caves in."

Desiree, sitting to one side, said,

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"I'll be heading back to Crisium the day after tomorrow. I'll make sure he holds off that long, at least."

Kent shook his head. "I still don't understand how *water* caused the quakes, though. It just seems like . . . I mean, rock is so, so . . . " He waved a hand in the air vaguely. "I don't get it."

"New London is in Mare Nectaris, right? Basically, that means that we're sitting on a huge slab of rock created by a succession of massive lava flows. As the lava cooled, stresses were produced—some parts cooled faster than others. These stresses, and subsequent impacts by meteorites, created faults . . . cracks, in the rock."

"I follow that part," Kent said. "What I don't understand is why those faults should move."

"That's something that Earth has over us. Earth is positively soggy with water. Every pore, every fissure is filled with water. All you have to do is dig deep enough and you'll find water. It's a positive nuisance in deep mines—it has to be pumped out continuously. People born here on Luna find it hard to understand just how pervasive water is down there.

"That water seeps into the faults, too. Just a tiny amount, to be sure, but it's enough. The water acts just like oil does in machinery, it lubricates the rock on each side of the fault."

Kent shook his head in wonder. "It's hard to think of water as a lubricant."

"Have you ever slipped on a wet bathroom floor?"

Kent nodded.

"Same thing, just on a larger scale. Faults are engaged in a continual battle between friction, which tends to keep the fault locked, and the forces that are trying to make the rock move. Water can tip the balance. Here on Luna, things are made worse by the fact that, since there's no ground water to lubricate faults, they've never moved, and a larger proportion of the original stress is still there. It took far less water pressure to start the quakes than it would in an equivalent situation on Earth, simply because there was more energy stored in the faults, waiting to come out."

"So why didn't the fault move as soon as the reservoir filled up?" Desiree asked.

"Just a second," he told Desiree. Turning back to Kent, he asked, "Do you know where Denver is?"

Kent said, "Sort of. It's in New Mexico, isn't it?"

Desiree smiled at him. "No, babe, Colorado."

Kent grimaced. "One of those square states, anyway."

"Don't worry about it," Barstow said. "I was born here, too. There are lots of places I should know on Earth, but don't."

Kent gestured at Desiree. "She was born in Georgia. She knows all that stuff."

"If she ever gets too smug about it, just ask her to reel off the twenty largest craters from memory. Odds are, she can't do it," Barstow said. "Anyway, the thing about Denver was that they had some waste water down there that they wanted to get rid of,

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so they decided to drill a deep well and inject it into rock strata way down below the surface. Suddenly Denver started having quakes, just like you had here."

"But—" Desiree began.

Barstow held up a hand to stop her. "Hang on, I'm just now getting to the answer to your question. They discovered that they could turn the quakes off and on like a switch. It was governed by a threshold in the pressure of the water they were pumping down. Below a certain pressure, nothing happened, but above it they started having quakes; and the higher the pressure, the more quakes they had."

Kent sat back, dumbfounded. "Damn! So we were all right until we increased the water pressure in the reservoir."

Barstow nodded. "And the tremors were telling me that right from the beginning, if I had only known what I was seeing. The pressure in your reservoir fluctuated above and below the threshold as people used water during the course of the day. When everyone got up and took showers in the morning, the quakes dropped off. In the early evening they stopped completely, because people were cooking dinner and washing clothes and taking more showers—the water pressure dropped below the threshold. After midnight the number of shocks rose dramatically due to the fact that everybody went to bed and quit using water. All three of the larger quakes were in the wee hours of the morning because that's when the pressure in the reservoir was the highest."

Kent nodded slowly. "We thought we were doing well to get the pressure up as high as we could, because it gave us a running start on the drop during the day." He sighed. "Well, we'll just have to get moving on the new reservoir, I guess."

"If I were you, I'd go to the extra expense to line it. A plastic coating would keep the water from seeping out into fissures in the rock. Look at is as cheap insurance."

Kent pursed his lips. "I don't see how we can afford it, but from what you're telling me, we can't afford not to." He stood and held out his hand. "Though I don't like the message, I won't shoot the messenger. You've done an excellent job . . . far better than I had hoped, actually. The best I had expected was that you would come in and tell us that there was some vanishingly small probability that we would have another quake. To be able to stop them completely . . . well, if I believed in such foolishness, I'd offer you the key to the city. As it is, I'll see to it that a bonus is tagged onto your fee."

After Barstow had left, Kent sagged back into his seat, looking deflated. He glanced over at Desiree. "I hope no one ever finds out just how close I came to single-handedly causing the biggest disaster in Lunar history."

She blinked. "You? How so?"

"I had a psychologist draw up a psychological profile of our friend Evan Barstow. In his professional opinion, Barstow has always been borderline neurotic . . . claustrophobic, that is. Calling Evan in to assess

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the likelihood of another quake put him on the spot in a way unlike any other judgment he has ever had to make. Performance anxiety, Tarver called it. Suddenly, people's lives were on the line. The psychological pressure seeped into the faults in his personality and gave him his own set of mental quakes, in a manner of speaking. His claustrophobia began to manifest itself."

"So he actually did have tunnel fever?"

Kent nodded. "It's no coincidence that he was drawn into a line of work where he could spend most of his time outside, on the surface." He shook his head. "It had never occurred to me to consider how a claustrophobe would cope with life in stone tunnels."

"So how does that constitute a crisis?" Desiree asked.

"I was talking with Tarver when Evan called. That Evan should demand such an apparently irrational, bizarre thing as to turn on every water tap in the city, well, Tarver was ready to stuff and mount Evan as a classic case."

"The psychologist was telling you to ignore Evan's advice?"

"Exactly. I shudder to think what would have happened if I had done so."

Desiree smiled as she observed sympathetically, "I daresay we'd all have done our share of shuddering before it was over." ■

(Continued from page 89)

carve out the extraneous dialog and involved phrases. What emerges is analogous to a sculptor's freeing of a statue imprisoned in a block of marble. Three months after starting to write seriously, he sold his second submitted story to *Analog*, "Love, Dad" in March, 1992. This required no redrafting at all, since he wanted a rough, unpolished feel to the story.

Heinlein, Asimov, and Clarke were part of the writer's growing up. He loved science fiction as far back as he can remember. The stories written by the authors of "The Golden Age" of science fiction, as it was developed in the pages of this magazine, had a touching quality of virtue and sanity. Those who went through the Depression and WWII have a view of the world that Jeff thinks our current generation needs to recapture. We made it to the Moon in part because the people who got us there read the type of SF that looks forward to a better time. Writers today should be aware that future men and women could well be inspired by what they read now in *Analog*.

By the time this appears, Jeff will be newly married, to someone symbolic of how our world is developing. Half-Japanese, and half old-line American, his wife already served to influence his writing. Having named his first story's extra-solar planet "Dorothy," after her, it's not likely that there will be any doubt that future characters in Kooistra stories will no longer be in Kansas. ■

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THE QUANTUM PHYSICS OF TELEPORTATION

Teleportation is a familiar idea in science fiction. It permeated the SF literature of the Golden Age, providing the basis for SF classics like Van Vogt's *World of Null-A* (1945), Budrys's *Rogue Moon* (1960), and many others. The Star Trek series' transporter has also "beamed" the concept of teleportation to our pop culture. But modern hard SF has largely abandoned teleportation as a concept that has more to do with fantasy and parapsychology than with real science.

Imagine my surprise then, to discover an article on the subject of teleportation in the March 29, 1993 issue of *Physical Review Letters*, that "hot-news" flagship physics journal of the American Institute of Physics. The article, by an international collaboration of physicists hereafter designated by the initials BBCJPW, does not provide a plan for constructing a transporter. Instead it describes an in-principle procedure for copying and transporting a quantum state from one location and one observer to another by a process that is characterized as teleportation. The BBCJPW scheme exploits some of the peculiarities of quantum physics and reveals some of the rules of the game in that exotic domain. Let us begin by discussing these rules.

First, we will focus on the quantum *state vector* (also known as the wave function). Any quantum system, for example an electron with the characteristics of position, energy, momentum, and a spin vector pointing in some direction, is completely described by the state vector, as denoted by the symbol $|\phi>$. Anything that is knowable about the electron is mathematically encoded within $|\phi>$. An essential rule of the quantum world is that the state vector can never be completely known because no measurement can determine it completely (except in the special case that it has been prepared in some particular state or some member of a known "basis" group of states in advance). In general, the quantum state coded within $|\phi>$ can only be "glimpsed" by a measurement of one

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of the properties of the quantum system. In the act of pinning down one particular property of $|\phi>$, the measurement destroys any opportunity to determine some of the other properties of the quantum state. The quantum state can be preserved unchanged only by refraining from making any measurements of its properties. This frustrating aspect of quantum mechanics is the essence of Heisenberg's uncertainty principle.

A second ground rule of quantum mechanics is that a pair of spatially separated quantum sub-systems that are parts of an overall quantum system can be "entangled." This bizarre property of quantum systems was discovered in the formalism of quantum mechanics by Albert Einstein and his coworkers Podolsky and Rosen, and is known as EPR non-locality. A measurement on one of the entangled sub-systems not only forces it into a particular state but also, across space-time and even backwards in time, forces the sub-system with which it is entangled into a corresponding state. For example, measuring the polarization of one of a pair of entangled photons precipitates the other photon, which may be light-years away, into the same state of polarization as that which was measured for its entangled twin.

The state vector, however, does not have to describe a microscopic system like a photon or an electron. It can describe large collections of atoms: chemical compounds, human beings, planets, stars, galaxies. There have even been recent papers in quantum cosmology by Stephen Hawking and others in which the properties of the state vector of the entire Universe are discussed.

But what has this to do with teleportation? The basic operation of teleportation can be described as determining the total quantum state of some largish system, transmitting this state information from one place to another, and making a perfect reconstruction of the system at the new location. However, since it is not, even in principle, possible to measure the complete state vector of even a very simple quantum system because of the uncertainty principle, as discussed above, this would seem to rule out teleportation on even small quantum systems as physically impossible.

"Not so!" say BBCJPW. There is a way around this quantum roadblock which exploits the peculiarities of EPR nonlocality to transmit the complete description of the state of a quantum system over nature's privileged communication channel without performing measurements that extract a complete description of the state vector as information. They propose a multistep procedure by which any quantum state $|\phi>$ can be teleported intact from one location to another (but only at a transmission speed that is less than or equal to the velocity of light). The BBCJPW procedure goes like this:

Step 1: Prepare a pair of quantum subsystems $|\alpha>$ and $|\beta>$ in an entangled state, so that they are linked by EPR non-locality.

Step 2: Transport one of these entangled quantum subsystems ($|\alpha>$) to

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the location of the teleport transmitter (the authors call the transmitter operator Alice) and the other subsystem ($|\beta>$) to the location of the teleport receiver (the authors call the receiver operator Bob). These two subsystems are correlated by nonlocality, but at this point contain no information about the quantum state $|\phi>$ to be teleported. In a sense, they represent an open quantum channel that is ready to transmit.

Step 3: Alice brings the teleported state $|\phi>$ into contact with the entangled state $|\alpha>$ and performs a quantum measurement on the combined system ($|\phi>$ $|\alpha>$). The details of the measurement have been previously agreed upon by Bob and Alice.

Step 4: Using a conventional communication channel, Alice transmits to Bob a complete description of the outcome of the measurement she has performed.

Step 5: Bob subjects his quantum subsystem to a set of linear transformations (for example rotations through 90°) that are dictated by the outcome of Alice's measurement. After these transformations, Bob's quantum subsystem is no longer in state $|\beta>$ and is now in a state identical to the original quantum state $|\phi>$, which has in effect been teleported from Alice to Bob.

The BBCJPW scheme for teleportation requires *both* a normal sub-light-speed communication channel and a nonlocal EPR channel to send the quantum state vector from one location to another, and also requires considerable prearrangement of entangled states and measurement procedures to make the transfer possible. It transfers the quantum system without having completely measured its initial state. The initial state $|\phi>$ is in effect destroyed at Alice's location and recreated at Bob's location.

BBCJPW analyze the information flow implicit in the process and show that Alice's measurement does not provide any information about the quantum state $|\phi>$. All of the state information is passed by the "privileged" EPR link between the entangled states. The measurement results can be thought of as providing the code key that permits the EPR information to be decoded properly at Bob's end. And because the measurement information must travel on a conventional communications channel, the decoding cannot take place until the code key arrives, insuring that no faster-than-light teleportation is possible.

It should be mentioned that while it is quite feasible to produce entangled quantum states of the kind needed in the BBCJPW teleportation scheme, as demonstrated by the pioneering EPR experiment of Freedman and Clauser and the subsequent experiments of Aspect and his coworkers a decade later, these states have up to now involved particles (photons) that are separating at the velocity of light and cannot be "stored until needed" as would be desirable for convenient implementation of the BBCJPW scheme.

The BBCJPW procedure, as mentioned above, is not a design for a machine that teleports macroscopic objects, e.g., human beings, from one location to another. It is concerned

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with the teleportation only of quantum states of elementary particles. However, since this is a SF magazine I am permitted to indulge in some speculation on the science-fictional implications of the BBCJPW work. The key element of the scheme is the entangled quantum state that provides the nonlocal link between the transmitter and receiver. It is difficult to visualize a complex entangled subsystem that could interact properly with a macroscopic object for the purposes of teleportation. It would have to contain the same ensemble of atoms in nearly the same arrangements as the object transmitted. For physicists, that's a mere engineering detail now that the in-principle feasibility of teleportation has been demonstrated.

So let's consider how macroscopic BBCJPW teleportation might be used in an SF context. *Example 1:* an advance terrestrial civilization sends out an exploration ship filled with macroscopic entangled states that are twins of similar states held in storage on Earth. If the ship travels at 1% of **c**, it will take twelve hundred years to travel the 11.9 light years to Tau Ceti. After it arrives, robots unload the ship and set up a teleport receiver unit for each entangled state. When everything is ready, the colonists step into transmitter units where they join the stay-at-home entangled states and are destructively "measured" by the transmitter. The results of the measurement are recorded and sent by radio or light beam to the receivers at Tau Ceti. The measurement information can be transmitted redundantly several times with error-correcting code to insure its integrity. Twelve years later, Earth time, the beamed information is received at Tau Ceti, the transformations on the entangled states are performed, and the colonists emerge from the receiver units. For the teleported colonists no subjective time at all has passed, and they have had a perfectly safe trip because it was known that the receiver apparatus had arrived and was fully checked out before the transmission was made. The explorers can also return to Earth, with the same 12-year gap in subjective time, using other entangled subsystems that were brought along for the trip to teleport in the opposite direction. Not, perhaps, as exciting as quicker SF trips to the stars using space-warps or hyperdrives, but a safe and efficient way of exploring the stars.

Example 2: a wormhole link has been established with a neighboring bubble universe, but it is discovered that the other universe is dominated by antimatter rather than normal matter. Is exploration within the antimatter universe possible? Sure. We know that entangled matter-antimatter subsystems can be produced, for example an electron and positron produced as a pair in an electromagnetic interaction. With macroscopic entangled subsystems that are matter-antimatter twins, the antimatter subsystem could be transported through the wormhole, after which explorers from our world might be teleported through the wormhole and converted to antimatter at the same time. A return trip with other matter-anti-

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matter subsystems would reverse the process, converting the explorers back to matter and returning them to our Universe simultaneously.

I'm sure that there are many other possibilities for SF themes based on quantum teleportation. We now have a physics basis for teleportation. Its uses in SF are limited only by our imagination. ■

REFERENCES

Quantum Teleportation:

"Teleporting an Unknown Quantum State via Dual Classical and Einstein-Podolsky-Rosen Channels", C. H. Bennett, G. Bradsard, C. Crépeau, R. Jozsa, A. Peres, and W. K Wootters, *Phys. Rev. Letters 70*, 1895 (1993)

Entangled States and EPR Nonlocality:

S. J. Freedman and J. F. Clauser, *Phys. Rev. Letters 28*, 938 (1972);

A. Aspect, J. Dalibard, and G. Roger, *Phys. Rev. Letters 49*, 91 (1982);

John G. Cramer, *Reviews of Modern Physics 58*, 647 (1986);

John G. Cramer, *Intl. J. Theor. Phys. 27*, 227 (1988);

C. H. Bennett and S. J. Wiesner, *Phys. Rev. Letters 69*, 2881 (1992).

If you approach each new person you meet in a spirit of adventure, you will find yourself endlessly fascinated by the new channels of thought and experience and personality that you encounter. I do not mean simply the famous people of the world, but people from every walk and condition of life.

Eleanor Roosevelt

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Ian Randal Strock

THE EARS HAVE IT

"Earth can't be the only one. There must be other intelligences out there. If not precisely like us, at least close enough that we could communicate. We have to try to find them."

"What do you suggest?"

"Well, it seems logical to me to assume that being intelligent, they'd be trying to contact others, as we are. In fact, they probably already are. They'd probably try to communicate electromagnetically, and it would probably be with radio waves. We ought to build a huge receiver, and then keep listening. . . ."

"We have become sterile, Preco!ng, insular. Our ideas no longer grow because we each know the others' thoughts. We need more contact. We need to talk with beings who have different backgrounds."

"And where, Kruny!tk, do you think we might find these beings whose backgrounds differ so widely from our own?"

"Out among the stars. Lo!thar!el can't be the only planet to have evolved intelligent life."

"And what do you suggest we do?"

"We must have such contact soon, or we'll stagnate and die. If we begin transmitting a signal now, by the time it reaches the stars, and the star-beings are able to answer, it may be too late. We should, instead, listen as intently as possible. . . ."

"But Zgorph, we are astronologers! We have long held dear the belief that life did not originate on Zzqolin alone. I put it to you that now is the time to prove that."

"How do you propose we go about proving it?"

"We must make contact with those otherworldly life-forms. We must communicate with them. Perhaps we ought to signal that we are here. I think a high-powered transmission of radio waves in some basic code to signal our presence would suffice to start."

"And how much would this high-powered radio transmitter cost? You know as well as I that the astronology budget has been decimated this past decade, and even low-powered radio transmitters have been rising in cost. Have you a cheap idea?"

"Well, I suppose we could instead build a receiver, and listen for such signals."

"Now you're speaking sense. . . ."

"Do you really think the Overseer will allow us to embark on such a

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difficult project as trying to talk to the stars? Scurrying around, sending signals, varying the means and directions of transmission? You heard her talk last week, saying that V'schuntlik would be a better place if it were a simpler place."

"Do you think the Overseer would allow a project to listen to the stars? Surely that is a simple thing."

"Perhaps, perhaps. I have an appointment with the Third Assistant Underseer next week. I will broach the topic then. . . ."

"We are recovering from the most devastating war ever. The war to finally unify all of Qu-shon, and now you want to use large amounts of money and effort to try to find extra-Qu-shonian life? Do you think the people would go for that?"

"I don't see why not."

"You don't see why not? What if your extra-Qs come and attack us? Everyone is tired from years of wars, and you want to invite more. You want to call some extra-Q intelligence, which can travel the stars, and have it come kill us?"

"Well, perhaps that isn't such a good idea. But if they're out there, oughtn't we at least find out so that we'll be able to prepare ourselves in case they find us on their own? Maybe passively listen for them?"

"Hmm. I may be able to convince the Budget Council of the utility of that suggestion. . . .

"Earth is now ready to take its place among the intelligences in the galaxy. We have active search programs taking place at Arecibo and the Very Large Array in the California desert. We're bound to pick up an extra-terrestrial signal any time now. . . ."

". . . Kruny!tk, you have your wish. Lo!thar!el now has listening stations all about its equatorial belt. If there are other beings out there, we will soon find them, and will be safe from stagnation. . . ."

". . . We've managed to have enough funds assigned the astronologers to build a receiver, Zornack. If there are indeed otherworldly lifeforms, Zzqolin will soon know. . . ."

". . . I am surprised, but the Overseer thinks that listening to the stars will not harm V'schuntlik's way of life. She said we could begin the project immediately. . . ."

". . . The Ruling Council has decided that listening for extra-Qu-shonian life is the most prudent course for Qu-shon. Accordingly, listening posts will be established. . . ."

Earth listened intently.

Lo!thar!el listened intently.

Zzqolin listened intently.

V'schuntlik listened intently.

Qu-shon listened intently.

Nobody said anything. ■

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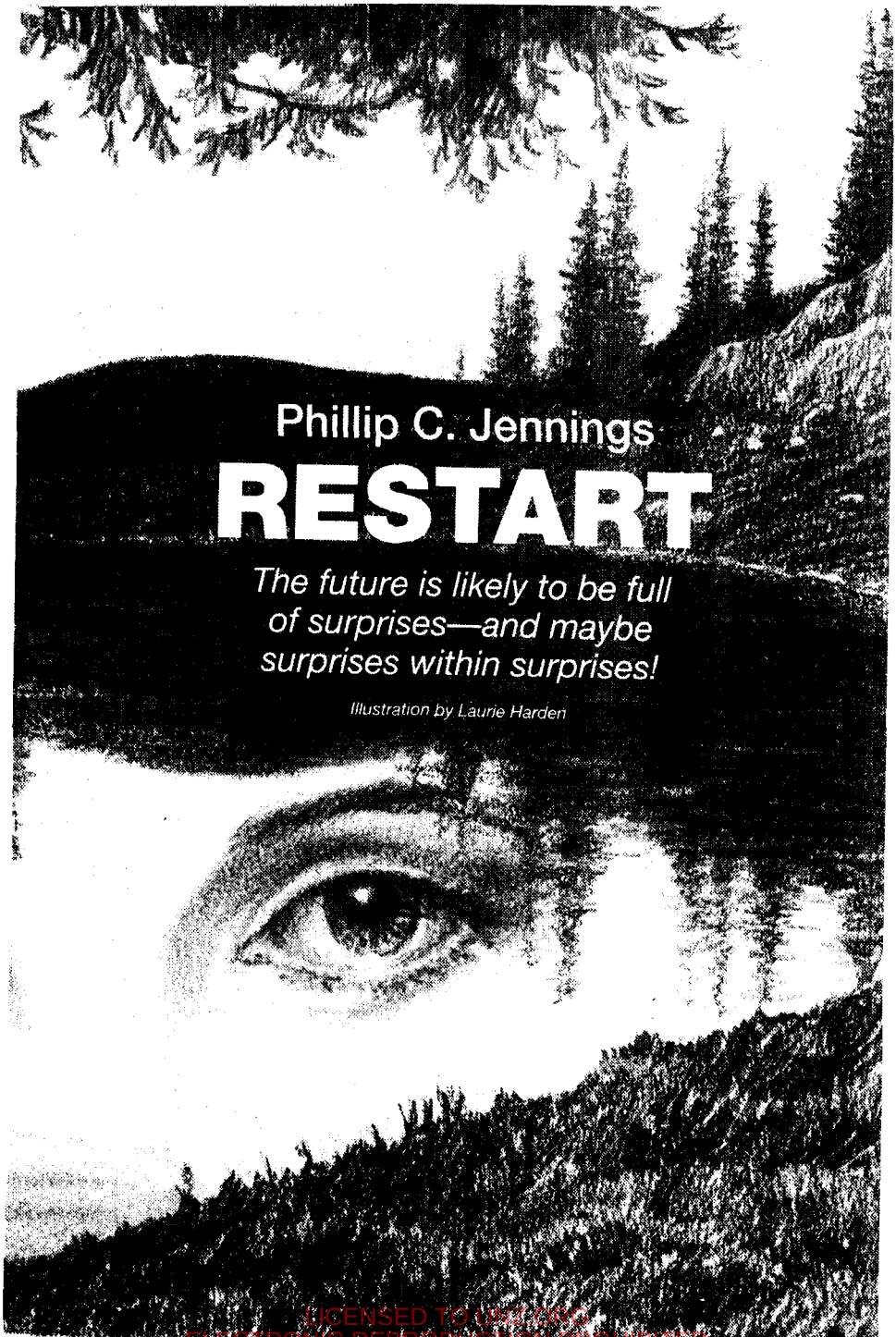
Phillip C. Jennings
RESTART
The future is likely to be full of surprises—and maybe surprises within surprises!
Illustration by Laurie Harden

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I flipped the ribs, painted them with sauce, and clunked the lid back on the Weber. It was early in the spring for barbecue, but all too late for the conversation I meant to have with my friend Bill. I screwed up my courage to insult a guy who'd driven forty miles to be my guest. "You're in a rut, pal. Always complaining about the same things. You've gotten stuck."

"Yeah?" Bill stiffened in uncertain anger, a small sharp sparrow-hawk of a man. He turned to face the choppy blue waters of Lake Ashtawena down slope from my woefully disreputable lawn. With oaks it was stupid to rake until well into April. Half the leaves wintered on the trees, until the March winds blew them down. Fortunately my neighbors felt the same way.

"Me too," I hurried to make amends. "We might as well grow old. I just don't want any more artsy-fartsy whining from either of us. All these undeserving twits getting rich. NEA censorship and idiot TV sitcoms. Grant all that. Holes in the ozone and George Bush in the White House. What about the *good* stuff? A generation from now they'll say these were the years when it all started coming together. Buckyballs. Virtual reality. Fusion power. God, it must have been exciting back then!"

Bill rolled his dark eyes at me. "Science saves the day! Yet another Pollyanna sermon from PWK's high-tech stocks guru. OK Matt, sure, you bet. Let's mail our kids to Australia. I used to have a life before the twins came along."

"Parenthood inspired you. You wrote that essay about Toys 'R' Us," I answered. "Anyhow—"

"I milked it dry," my literary friend interrupted. He fell silent, swirling the non-alcoholic beer in his mug. It was time to launch into a panegyric of the new software I'd gotten. Not yet quite time to talk about the investment prospects. Bill sidled into the barbecue smoke, the better to discourage the mosquitoes that had spawned after Thursday night's rain. "What the hell is that?" he asked as I mustered my powers of oratory.

The town of Ashtawena used to be saltbox lake cabins before the expanding megalopolis swallowed us up in suburbs. "That's the Department of Natural Resources," I told my not-very-captive audience. "It's a DNR swamp boat, like down in Florida. They buzz around every so often to make sure we're not denaturing any last bits of woods."

"Talk about noise pollution. Jesus!" Bill set off toward the shore. He gentled his way around a gaggle of Canada geese. "No, wait. They're spraying something."

Suddenly Bill doubled over. A muscular convulsion sent his hat flying, but the rigor went out of him and he fell to the ground like a rag doll. I dropped my drink and ran toward my friend's body. The last thing I remember was a strange smell in the air.

Wheeze-tweet. Wheeze-tweet. Swedish clog dancers. A burst of machine-gun fire. More wheeze-tweet.

A man's voice said "Labdlalat lumma."

"La?" someone answered.

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None of the next string of articulated syllables had an "L" in them. They'd used their quota.

Something was breathing me, pumping my chest. The syncopation had nothing to do with the wheeze-tweet. I found myself staring at curved beige plastic, inches from my face. The metal doohickey at my focal point looked like a showerhead, or maybe a microphone.

I felt awful. The taste in my mouth was worse than death. It should have greened the air. I heard more "machine-gun" noise, except too regular. I needed another metaphor. I couldn't move. I was paralyzed!

A male voice said a lot of stuff, ending with "en-seem-oh." Then he said a lot more stuff, ending with "en-seem-oh" again.

"Enzyme," someone answered.

"En-sam?"

I was very tired. The last I remember was a face thrusting into view. It smiled and chanted: "En-sam. You en-sam go go." I faded back out of existence.

I opened my eyes to too much daylight.

"You feel sick. It's to be expected. Most likely it will take three days for all the epitithymase to tidy out of your system."

"Huh? Oh, shit," I whispered. I wanted to throw up, but I didn't have the gut-strength. I was on some sort of mechanical chaise-longue. To my left a window glowed until *she* touched it. She'd been a shadow. Now she was less of one and in any case the backlight from her clipboard illuminated her face. Female. Pink outfit and black page-boy hair. Jacqueline Kennedy déjà vu.

I was too feeble to have an agenda. I'd vent my anger on the DNR, but not yet, not until I had some heart to put behind my words. Anyhow, all those barbecue memories swam around a great lens-shaped distortion, a vacancy that told me I'd been unconscious for—well, *days* maybe. When I felt less nauseated I'd ask about Bill. . . .

"What year were you born?" she asked in a nurselike manner. I thought I recognized the do-you-know-who-you-are routine.

"Forty eight."

"Cohort ID?"

"What?" Already I had a headache.

She came over and laid a cool hand on my forehead. "I think you came too early for cohorts. I think . . . *1948*?"

"Yeah." I may not have made a sound, but my lips moved.

Hers too. "I have some lies for you," she whispered. Her skin appeared to be Chinese and her eyes were slightly Oriental, but she could have been anything. Pretty, for sure, with glossy magenta fingernails that went with her outfit, but contrasted as well, their dark red eroticism versus her 1962 chastity. Not American. She spoke too precisely for that.

The walls around us were government green and featureless. The last time I'd been in a room this stark was when U.S. Customs gave me the third degree driving home from Winnipeg.

As I worked my eyes, my hostess clicked through some clipboard dis-

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plays and nodded in confirmation. I must have been in there. It was official—Matthew Ross really existed. "I'd best get started," she said. "Keep your wits about you. Even without interruptions this is apt to take a while."

Here's what my Pink Lady told me. The 21st century had been tough. We wouldn't have made it as well as we did if a few billions of us hadn't gotten parked. Timed out. Biological engines turned off.

It wasn't death, she made that clear. The difference is that enzymes function all too well in death. That's what causes decay. Lots of my enzymes *continued to function after* I'd gotten sprayed by the DNR. I'd lost so much muscle tissue in my legs they'd had to amputate. My arms were little better than skeletal.

This was true, I saw, now that I bothered to look down. True, and just a bit interesting . . . nah. Not yet. I was a wizened horror, and among the things that had dwindled were my feelings. I was apathetic. My decrepitude barely bothered me. Positives and negatives were irrelevant.

At least I'd gotten out of raking my lawn. A permanent absolution. I sighed. This small experiment in cheerfulness registered zip on the scales. I tried feeling sorry for myself, with scarcely greater success. If only I could throw up.

The Pink Lady hurried on like she had a dozen people to educate today. She'd done this sort of thing before, and gave me a practiced smile as she got to the good news. Where my circulation had been strong enough to spread around that epi-ase stuff, I was functional. That included my brain. It was an interesting brain. I took her word for it, because if you feel like I did, nothing is all that interesting and *absolutely* nothing is worth getting reborn for.

That's the word she used. "Reborn." Folks were picky about whom they shared the world with. They left the slugs for a future decade. The stupid, the depressed, the obnoxious—frozen out like that, they didn't have a chance to multiply. All the consequences were happy and glorious. The smile she gave me was only slightly cynical. Was she studying me? Was I buying all this? Was I *really?*

A miracle anti-enzyme. Stuff that locked up my metabolism. The world had changed, but the miracle had been around for me way back whenever. Pink Lady said I was lucky to be revived, lucky to be chosen, but I knew I was implausibly lucky to be *revivable.*

Here was a puzzle almost worth getting stirred up about. I was on the verge of caring—yes. If nothing else curiosity gave my brain something to do, other than fall back asleep again. What were the lies she'd warned me against? Her future utopia talk might be true, but if it was, what about her claim that *epi-tith-y-mase* had anything to do with me?

Just as my mind was getting personal about all this, Miss Oriental Jacqueline Kennedy clicked on a video with mass-produced answers. How 20th century! The narrator even sounded like Walter Cronkite. Maybe

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she was using old-fashioned methods to reassure folks like me. That explained the Jackie Kennedy dress. I rolled my head weakly. My costumed counsellor touched a button and the chaise longue angled up a few inches. I had no strength to reach for the glasses that weren't there anyway, but at this distance my eyes weren't bad.

The theme music was full of classicized heavy metal flourishes, synthesizers banging away at a leitmotiv stolen from some Armenian church liturgy. My wall dissolved into Scene One; athletics and lots of bonhomie.

A frozen crystal waterfall forked around an outcrop of limestone. The whole thing encompassed a fireplace pit, like in an ultra ritzy hotel lobby. Except this place was clublike, a bar or a student union lounge, or a health spa of a special sort, where nobody worked against the tyranny of the clock. The camera panned over a potted rhododendron and I saw tall, strappingly muscled Cossack-Mexican-Filippinos, racially blended and handsome as Greek statues. "A population of one billion guarantees that the ecological disasters of former eras no longer afflict the present world," pseudo-Cronkite announced cheerily, while my eyes took in a scene of happy sweat, towels, incomprehensible jokes, laughter, and crackling flames.

My Pink Lady didn't belong in this hearty crowd. I was watching a beer commercial where they were selling the 23rd century instead of Budweiser, and she was white wine all the way. Lord help me, it was true. She was too fine for a guy like me, even before I'd shriveled into my present condition. At last I remembered my manners. As the overvoice chatted about asteroid colonies, I whispered for her name.

"Mem Judita," she answered quietly. She patted my feeble monkey-paw hand. "Pay attention. We will talk again afterward."

We did. She told me my "file date" was 1992, a solid connection to all my memories. My family and friends were separated from me by two hundred and ten years. Two hundred ten lost years ago I'd barbecued beef ribs under budding spring oaks, while a voice on National Public Radio bitched that too much of the Earth's biomass was taken up by cattle. I imagined a couple centuries worth of non-rotting corpses. Talk about biomass. We must be sitting on a geological stratum of humanity by now!

God. God God God God. I was naked in every way possible. Stripped of my family, my job, my glasses, my books, my computer, my house . . . my politics, my geography. I burrowed into the past like a rodent looking for its hole. "What happened to me back then?" I asked. "Poison gas? Some accident? Can I call you Judy?"

She smiled as if honored by my attention. Either it was genuine kindness, or a triumph of professional etiquette. "It will be good experience for you to hunt out your history. We'll top you up with a computer interface." She touched her hat. "What sort of personality do you want your wheelchair to have? Male?

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Female? Insouciant? Sultry?"

Where'd she learn English? But I suppose after my extended windiness, I deserved to get hit with *insouciant*. "Just the regular," I answered. Maybe I was feeling better. Half the time I was up to full sentences.

Clearly my fake death was wearing off. Mem Judita showed me where the chaise longue's buttons were, and lo, this thing was the wheelchair she'd talked about. I made it do lots of things; up, down, forward, back. IV's and catheters connected us in the most intimate way. "You can use voice control too."

"You bet, honey," my chair agreed, and suddenly she was an older woman, probably a 20th-century New Yorker and tough as nails. So this was the standard personality! *Intrusive* was the word that came to mind, but my wheelchair never spoke again, not until Judy left my room and I asked her if there were any other videos I could watch.

I named her Myrtle after Grandma's cigar-smoking sister, who retired to Florida from the Norwegian part of Brooklyn and turned into a ripsnorting Pentecostalist. When she died her record collection was full of Jim and Tammy inspirationals, but that's not the way I remember her.

Myrtle number two set me up with a few travelogues: Earthzoo and the Rasta Reservation, and an offworld visit to Mormon Station in the Iris colony, touching on the high moments of Pageant Week. The hours went by. My moods thawed out and I began to feel an intolerable mixture of sorrow and excitement. Up, down, up, down. The emotional seesaw was maddening. I'd have paced in circles like a caged lion, but I was much too weak. Maybe on one of those asteroids with 1 percent gravity....

Oops. No legs. What an astonishing thing to forget! Damn! I touched my thickly-padded stumps and fought back my tears. I was a cripple with an obsolete education. Even if the brokerage house of Pinchott, Wolder & Kahn continued to exist, I was the last person they'd want as a high technology stock specialist. What was I good for? Why was I reborn?

How much of this was lies? Me, my chair, my room, these videos—I had to believe what I saw firsthand, but maybe it wasn't the 23rd century. Maybe a gang of chemical industry people were working on my head. By some blunder I'd been sprayed—by *epitithymase*?—and they were playing tricks to escape liability. They were driving me nuts, using contradictions to wipe out my sense of reality, except my dear Judy was too fine a soul to play their game 100 percent.

No, it hardly made sense and if it was true they were compounding their crimes, but 210 years is a lot to swallow.

I swallowed with reservations and a muddled sense of resentment. How come I was alone? If I'd belonged to a *cohort*, I'd have wakened with people from my era. Some effort would have been made to batch me with my acquaintances. We'd face the future together. The whole prospect of rebirth wouldn't have come as a surprise.

Obviously that sort of institutional-

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ized thoughtfulness didn't extend back as far as fossils like me, but just maybe—well, I'd have accomplished something if I knew my people were "filed" and not dead. According to that first video, if Dawn or Melissande made it to 2005 they'd have had that option. The technology was commercial by then. If they'd lived until 2018, they'd have accepted it as a right. After 2036, they'd have been subject to a lottery. Earth badly needed to cull its population.

In junior high I'd memorized the year Eli Whitney invented the cotton gin. I'd forgotten since then. I'd forget these dates once I found out about my family one way or the other. For now, though....

For now, I pondered the thirteen year gap between 1992 and 2005. What did I have for comfort? My deep spiritual wisdom? Soft-voiced Judy, busy on her daily rounds? What could I ever be to her but the top half of a revived cadaver? Could wheelchair Myrtle soothe my spirits?

No, all I had were the calculations of my bewildered brain, and the numbers didn't add up. I clung to that thirteen-year void as if it were my lifeline. My mind probed it like my tongue would probe an aching tooth. A lie that left so much time open was no good at all. Only reality could be so careless.

Only reality. Only reality.... *What is the Truth?* But my mind had done all the thinking I had energy for, and I dozed off.

I awoke some time later. I experimented with my wheelchair's buttons and waited for Judy's next visit. She'd come back, right? And look at me as if the sight wasn't horrible.

Cute. Toggled one way, the direction keyboard moved Myrtle and me. Toggled the other, it moved my video wall. Well no, not *into* the other walls. That violated the laws of physics, but forward and back? No problem.

In this new mode my *convert-Myrtle-to-bed* button shrank the vidwall downward. The next room over was empty. I annexed some of it, and zoomed my wall up again.

I kept playing. It wasn't just the vidwall. Anything my two eyes focused on was willing to be squeezed, stretched and relocated. I made my window disappear, or maybe it went transparent. Daylight mangled the outdoor sky. I tried to move the sun.

The sun stayed put. I felt relieved. Some things shouldn't be possible. My godlike powers—wait a minute. *Nothing* moved anymore. They changed colors instead. I'd stumbled into a new mode of visibility options. That damned toggle went sideways as well as forward.

Federal green wasn't my favorite shade. After ten minutes of trial and error my room was a gorgeous mix of Santa Fe pinks and browns.

Could *everybody* in the future do this? Wouldn't we get in each other's way? I felt a sense of uneasy guilt as the imaginary prosecuter in my head intoned *ignorance of the law is no excuse.*

Without warning my room reset to green, and shrank. Judy whisked in the door. The pillbox hat on her tray

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matched the one on her head. She smiled and snugged it down over my bony skull.

Snap. Snap. She took my hands and prayed them together. *What the hell?*

Pop

I was tall, lean and naked. The grass was lush and wet and soft on my bare feet—the earthen dam up ahead was brimming over in our direction so we were standing in a cold new river that hadn't yet carved out a bed, a few inches deep and fifty feet wide. A gray-white sky promised more rain. We slogged uphill against the flow of all this marshy greenness. A rambly shack lay on the high left bank of the impound pond, its unpainted planking buttressed by side-shacks and fences. What few trees there were stood nearby, cropped bare to a certain height by cows looking for variety in their diet. Judy led me toward the farmstead.

Whoever lived here collected antiques; horse collars and cream cans and that sort of clutter. His yard and porches were busy with display tables and the inside was even more crowded.

You can smell out owners—they have a way of radiating hostliness. This guy came out from the next room. He was taller than me and handsome, a Scandinavian hillbilly in suspenders. He smiled. "We'll have to get you some clothes. Sit down. Enjoy yourself. My name's Er Cosba Voski."

"Matt Ross. I'd rather stand," I answered, and glanced down at these wonderful legs I seemed to have, kneecaps and muscles and gooseflesh and tendons, hairless but ineffably male. "I've had enough sitting."

"Yeah. Mem Judita, do you want to make the phone calls?"

"Is this my computer interface?" I asked doubtfully, looking around the dark interior. "Is this how I find out about my past? About 1992?"

"Let's do it artistically, if you don't mind," Er Cosba answered. "I've got stacks of old newspapers."

Maybe humans would be lost inside our computers if we didn't do it this way. I wriggled into the anachronistic flannels Er Cosba found for me, while flipping back through time-browned piles of the *Daily Chronicle*. A moth flew from nowhere, dusty gray and big as a hummingbird. I swatted in horror and it fluttered evasively. Judy set down her earpiece to tap my shoulder. "Let it help you."

The moth lighted midway down the next stack. I found the paper it had in mind. I opened it with a grimace and flipped through.

I'd made page one of Local & Regional, under half-inch headlines. I read about the accident. A genetically tailored pesticide was supposed to protect my trees against oak wilt, except they'd used the wrong canister.

The gas had "killed" the DNR boys before it toppled Bill and me, and did in a sun-bathing teenager as the swamp boat skidded onto shore. It wreaked permanent injury on everyone who came to investigate. It killed six geese. The spray cloud sickened a few more folks who happened to be downwind.

Us legally brain-dead were kept on life support pending eventual autopsies—*that's* the sort of news blip that

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boggles the average reader—and there was some debate about our status. The story must have been elaborated, but not in this particular paper.

The moth flew toward a low bookcase. It had one of those slide-up-and-tuck-in glass fronts than never works for me. Finally I wrestled it out of the way, and reached for the *Documenta Pharmaceutica,* volume seven.

The first research study on epitithymase was published by my local university, and the little synopsis at the beginning referred to "the tragic events which gave rise to this work." The year was 1996.

So.

I guess a guy who sailed with Columbus would be a big shot two centuries later. The way it sounded, I was a first day victim of epitithymase. By accident I was important. By accident I was a curiosity.

Er Cosba Voski collected curiosities. He was a leader, and he also collected followers. They came popping in as Judy summoned them by phone. One by one they shook my hand. The future was sexist—most of them were male. We were going to have a meeting. There was going to be coffee and cookies. Folks made an effort to talk the sort of John Wayne English that went with life in rustic America, except for rapid bursts in some other language. Some of these guys weren't polyglots—me neither—and to them I was introduced as *U Matu Ras. U* meant I didn't have a cohort, and people tisked at my tragic orphanhood.

If I was the cause and center of all this hoopla, I'd know Judy'd been faking it before my nap, when she had to look up who Matthew Ross was. Because she knew already. There were plans for me.

I'd know. Yes, I'd know, except fate wasn't about to let me know anything, and as I circulated I found out I wasn't the focal item I'd hoped to be. Sure there was a colony and I was invited to join it on Judy's recommendation, but any bunch of people who'd spent fifty-five years settling a new world has a lot else to talk about: weather and seed-stock catalogs and ghosts and whether this-and-such was legal or not.

I wasn't quite bewildered by all this. I had a metaphor. Every time you dream, you create a world. By using the tools of virtual reality, people like Er Cosba Voski took that dream, made it public, had it obey most of the laws of *real* reality, and then opened it to immigrants.

They'd been working here for most of a lifetime, and all of them still young because *externally* this area —this *hyperscape*—was only sixteen days old, and few of them had expended more than forty hours by God's true clock. With the help of those funny computer-interface hats, people snapped into the surroundings they liked, healthy and agile for enormous lengths of subjective time. "Another way of cheating death!" Er Cosba told me at the end of his little talk. He was something like the local mayor, and this place's biggest booster.

"Why even bother to have a body?" I joked back at him. Especially if it's not up to par, I thought to myself in a spasm of self-pity.

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The way folks stared, I must have farted.

"He's an innocent," Judy apologized in my behalf. "He came from very long ago. That's why I thought he might be comfortable in these surroundings. He knows nothing about ghost wars, or saves, or system crashes."

"Saves? Like backups?" I asked.

Er Cosba nodded. "Let's face facts, pilgrim. You better believe we got problems. Not here, not yet, but it always happens. If it gets bad enough we abandon the hyperscape and start over. You're dealing with a gun-shy outfit here. I mean, sure. Ghosts are people and most of them keep where they belong, but the other kind always ruin things."

"For themselves too," someone agreed.

"They don't give a damn about the rules," another fellow explained. "They break in just for the sake of raising hell."

"When it happens, we document the glitch and roll back," Er Cosba told me. "Then we restart. Everything since our last save? It never happened. We do it over, and mostly we catch the ghost. I mean, he doesn't have a chance. *He* can't play hob with time the way we do, and leave himself clues."

"But he doesn't remember getting defeated either," Judy added. "Every restart he's fresh off the shelf. He's as full of the devil as the day he was born."

I was paranoid enough to wonder if they were talking about me. I was newborn, but maybe for the umpteenth time. No matter how you looked at it I was an outsider, sufficiently alien and sufficiently ignorant. "But that's the difference," I speculated, hoping they'd correct me if I were wrong. "Real people have bodies, and interface-hats. Ghosts are —what? Control points inside the computer? What we used to call *viruses?*"

"Mind stuff is brain stuff," Er Cosba intoned, like it was one of the ten commandments. "Brain content is physical. Once you've got the protocols, you can copy it to EMP media. What you get is ghosts in a machine. For ghosts, this kind of thing—" (he waved his arm) "—is their *only* reality. That's their weakness. We can do end runs around them. We can restart and replay until things go right."

His eyes took on a distant focus, as if he were remembering something like what he was talking about, some past struggle. His voice dropped. "We'd as happily live with them in peace. And it gets so damned tiresome."

"Wars. It started with convicts," Judy said. "People condemned to die back in the 21st century. The courts copied their souls to disk, and gave them a ghost life inside virtual partitions. The authorities felt less murderous that way. Scientific new ways of absolving guilt! The things people do to feel good about themselves!"

"Ethics in government," Er Cosba said.

"Ethics!" Judy repeated scornfully. "If you know anything about death-row felons, most are too stupid to crash out of bounds, but in time one

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or two did. They distributed bits of themselves into unused space. Parts got written over and lost. They shrank and lost their humanity. Soon they couldn't function. Souls are too big to act like viruses. Meanwhile our software boffins stepped up system security. We've always enjoyed a tilt in our favor. We aren't *afraid* of ghosts—"

"No, but they louse up the neighborhood," someone joked. The gang laughed nervously.

Someone changed the topic. A liberal, probably. We were skirting the edges of bigotry. "How can I go about leaving backup notes for myself?" I asked. "I'd like to do some scribbling. I'd like to organize my thoughts. I—I know it's kind of you to invite me into your colony—"

Er Cosba nodded with hurried enthusiasm. "And you need to learn how to do a save. Ah yes. Here we go, pilgrim."

He took a Tibetan prayer wheel from a cluttered table top. "Stick your data in here and whirl. That takes care of everything. If you want to retrieve after a restart, go outside and raise your arms like a Hebrew prophet. God's dove comes down like a carrier pigeon, with a packet on its leg."

"Local protocol," someone added, scratching as if his long johns itched. "It's different in every world I live in."

"But this is *your* prayer wheel," I told my host.

"Uh, yeah. I'm sorry. If you want privacy—well, it's putting the cart before the horse." Er Cosba blushed a little. "Once you sign into our colony we'll license you assets and teach you how to use them."

I shrugged. "Let me take a little walk. Notes or not, I've got a lot in my head to deal with. Judy?"

She winked. "As you please. Keep a watch out for cow pies. Take care. It's your afterlife you're pondering."

I smiled a tight little smile. Yes it was, and as it happened I didn't want to expose my thoughts about it to Er Cosba. I squeezed my way through the party to his door and the fresh air outside. The skies were dim with the weight of rain.

I set off walking, and shook my head. 'Er Cosba!' All those articulated *L*'s! What was I supposed to think? An entire new language could spring up in two centuries? Especially when the same people might be around at the beginning and the end? If anything, linguistic development should slow to a halt.

OK, it might be artificial. Bizjot could be a pidjin; Spanish-Farsi-Swahili-Chinese. I was wasting my energies on a subject I knew nothing about and it was starting to drizzle. I found a tree to stand under and took stock. These guys were feeding me what kind of lies?

Lies about time. They'd given me a story to account for the thirteen years between 1992 and 2005, but was it true? Was this year actually 2202? Or a dozen centuries later? Long enough for new languages to evolve?

Judy had warned me. She'd also done one other thing. Unless folks could do amazing tricks with special effects, she'd let me discover that my *real* reality wasn't real at all. That business in my hospital room with

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the shifting walls and changing colors was absolutely stupid if the point had been to convince me I was an amputated half-corpse. It was 100 percent counterproductive. She could have conjured up a Myrtle wheelchair without a magic toggle switch and I'd have been none the wiser.

Was she dumb? No. Then why blow the story? What was her game? Could I trust Mem Judita? She had to be a double agent. There were at least two sides, Er Cosba's and someone else's. Maybe Judy was pro-ghost. My Pink Lady was a sympathizer with the outlaw underclass.

I envisioned a setup where people nested one virtual reality inside another. Or maybe these *hyperscapes* weren't that well organized. Maybe they were higgledy-piggledy. You could get lost and never find your way out. Take off that pillbox hat. You wouldn't know if you were unplugging onto God's own Planet Earth, or if somebody had done a nifty job of taking it to keep you from your birthright.

I wouldn't know, anyhow. In a universe of computer magic, I wasn't even an apprentice magician. Ignorance made me less than equal in an environment where knowing how to create and map and move among worlds was essential to having any status at all. Even ghosts mastered a lot of these things, but not having physical bodies was a handicap. Virtual realities were dependent on outside systems or they couldn't exist, and my old-fashioned physical universe was the ultimate bedrock.

Me? I wasn't going to learn where I ranked in all these hierarchies, not by sheer deduction, but if I had to put my money on it . . .

(and I did)

. . . I'd say chances were I *wasn't* real. I shook my head derisively and muttered: "Matthew Ross from 1992? Come on, now!"

"You were in a coma," the tree said.

I turned around. Bill stepped out the way ghosts do in movies. Right out of the trunk, to the side facing away from the shack. "We both were," he said. "We lingered for more than a decade. They used epitithymase on us when that became available, but in the end they wrote our brains to disk."

"I'm a ghost? Hey Bill, it's good to see you!" I grabbed his hand and started shaking it. My friend was his usual self, slim and small-bodied, with a hint of Hispanic about his eyes, but he had a full head of hair like before he started balding. No need for hats in *this* afterlife.

He lowered his voice. "Thank Mem Judita. She called me here, and I only hope it's not a trap. Hey, hey! Don't expect a big reunion. It's only been a couple days since they managed to sneak a copy of you. What'd they do? Purge you back to zero?"

"Last I remember was the barbecue," I began. "The DNR swamp boat."

Bill nodded. "Typical. We'll merge you into yourself. You can recombine all your memories. Follow me."

My old friend led me into the tree trunk. **Snick.** Next thing we stood on a darkling plain, among the stones

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of a megalithic ring. "Buncha wetbrain dilettantes," Bill growled over this place's background music. "Maybe they'd have gotten you to general for them. They know we're colonizing the western continent, and we've learned how to sail against the wind. Pretty soon we'll make contact."

"General?" I asked. The stones sang, each its own note, clear as glass and softening into the general harmony as I circled away.

"That's your job. Matthew Ross, El Supremo with five stars. They're the Anglos and we're the Mexican-Indians. God! With all their advantages, playing every battle over again whenever they lose, they *still* don't like the odds. So they steal our talent." He laughed. "You'd do their thinking for them."

"Oh shit. What is all this? Just some war game?" I asked.

"Eventually," Bill said. He sighed. "It always comes to that. Not yet. We settle, we develop, we trade. War's no good in the early phases. But you've got to know: 'Scapes like where you were, they go one way or the other. Ghosts or wetbrains, one side wins." He waved at our melodious surroundings. "This is ghost country. One of your victories. It's hard to believe it means nothing to you."

I shook my head. "You call the other side 'wetbrains.' They say bad things about ghosts. Ghosts cause system crashes."

"We break the rules," Bill agreed. "You think I'm *supposed* to walk out of a tree? Yeah, but the crazy ones get themselves killed."

"And restored." I shivered in the wind. "Purged to zero like me."

Bill put his hand on my shoulder. "Do you know what's going to happen? Do you know about all those epitithymased corpses?"

"That's true, then? *Epitithymase?*"

"Billions of them, perfectly hydrated in temperature-controlled hammocks. Too many to return to life. Too expensive to keep as they are. But you see, promises were made, and wetbrains have ethics. What can they do but make more ghosts? And we're better at living inside the machine than *they* are. We do it full time. They've biased the system as much as they can in their favor, and still we win half the time. It's got to be depressing."

I nodded. "They're going to do what they did to me, a billion times over." I thought of Judy. "It's a tactic anyhow. Some of them don't like the idea. I suppose she's got scruples." I didn't bother to say who *she* was.

"What's that?" Bill quirked his head. "What did they *do?*"

"Lie. Lie systematically, repeating what's soon to be one of the biggest lies in history. I'm a prototype. All those reborns will think they've got bodies, except they're cripples. Helpless in outer reality. So they'll be nice and behave themselves the way responsible citizens should."

"Huh!"

"It's going to work, too." I looked at Bill sadly. "Something hideous happened to me. I guess it happens to all ghosts. I lost a big hunk of myself. I don't ever want to do that again. The insecurity—the bewilderment—"

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"We'll get your memories back."

I opened my arms. "And it'll destroy the person I am now. How many centuries of memories, Bill? Two? Twenty? I'll be lost in all that!"

"Make up your mind," he said. "What do you want?"

A galaxy lay spread across the night sky. Shooting stars streaked down. What an astronomer's paradise! I paced and answered. "To be like *them*. To have their power to save and restart so I never lose very much again. And I can write those bits down for safekeeping. Take me back to Er Cosba and they'll treat me like I'm a wetbrain."

"Until they decide not to."

I shook my head. "They *want* to be fooled. And when they decide I can't be all that stupid and I'm not suckered in by their lies anymore, they won't take my powers away. Not if I've been good all the meantime. That's ethics, isn't it? What's the fun of popping out of trees anyhow?"

"What's the fun of being a—a magician?" Bill asked incredulously. "Of knowing the software so well you can make the bugs dance for you? What's the fun of *freedom?*"

"The other me can do that. I'll take my own road."

"Uh-uh." Bill crossed his arms. "Why should I take you back to that gang? Why let wetbrains use your talents?"

"If the other me is a general, don't you have to obey him?" I asked.

"Maybe." He shook his head doubtfully. "Maybe when there's a war and martial law. We're not a very obedient bunch, us ghosts, but we make do."

"Listen to him," I said. "Ask your own Matthew Ross. He'll tell you to send me back."

Bill looked at me. "You can't know that. —Can you?" I returned his stare. Then he shimmered out of existence, leaving his frown for very last.

Judy shot me a look of surprise when I came back out of the downpour into Er Cosba's shack. I repaid her the wink she'd given me earlier. "I've decided," I said. "I want to join you." *We're going to get to know each other, my dear Pink Lady. Ah yes, it's sinking in. I'm* whose *double agent now? And you? We'll watch each other from now on. Always so eerily careful.*

New life. New love? I had my hopes. Er Cosba smiled. Folks thumped my soggy back in welcome as I squeezed forward to take his hand. ■

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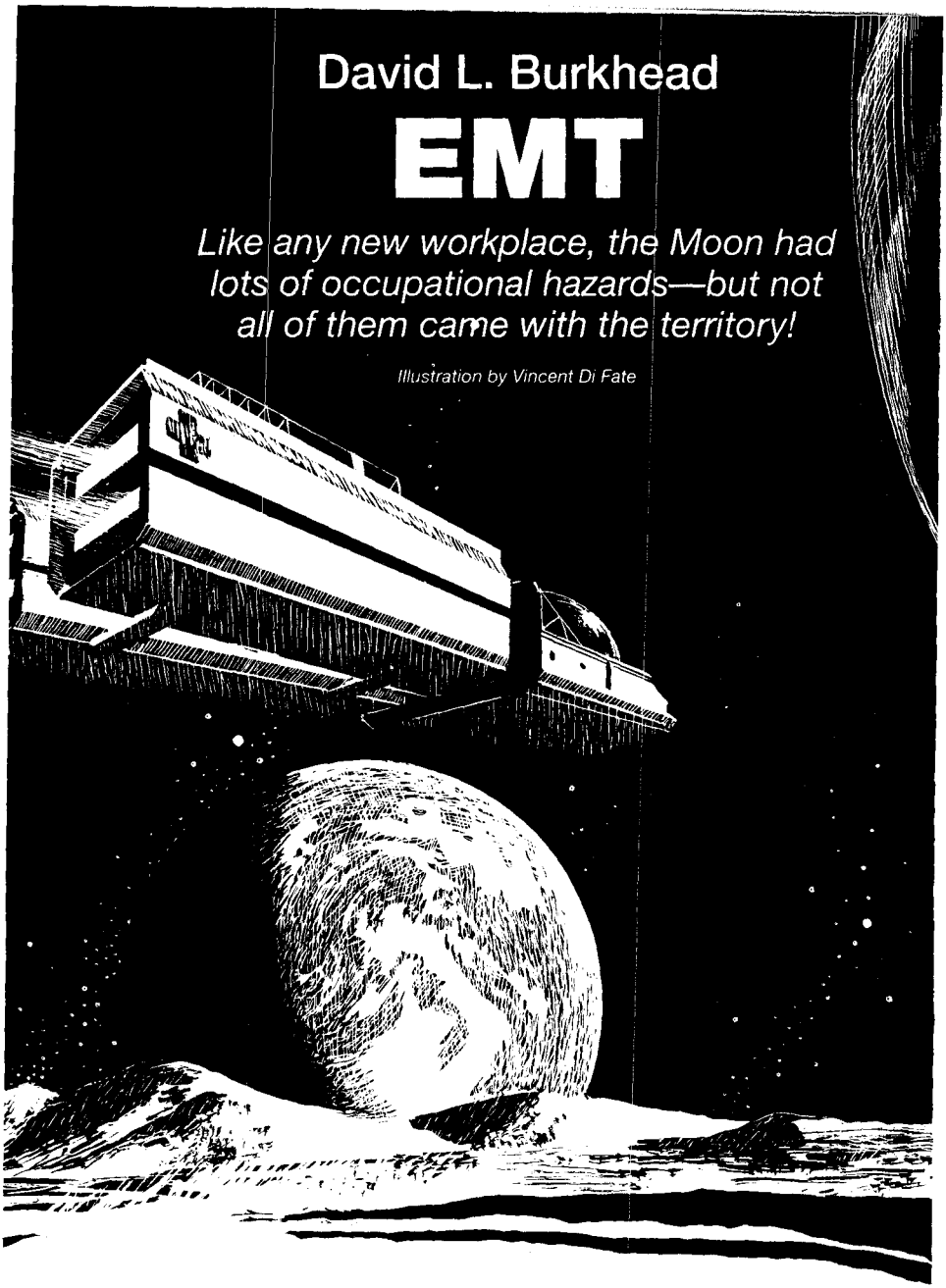
David L. Burkhead

EMT

Like any new workplace, the Moon had lots of occupational hazards—but not all of them came with the territory!



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William Schneider slapped at the key that cleared the screen of his computer. He looked up at the person who sat across the desk from him. "Are you sure about this?" His right knee ached as it did increasingly often of late, legacy of an injury in his youth.

Schneider was president and CEO of FutureTech Industries, FTI. Based out of the L5 colony O'Neill, FTI was one of the largest corporations in existence. Schneider usually surprised people with his youth—thirty-four.

"Yes, sir," Colin Knapp, a new accountant in FTI's analysis section said.

"Let's make sure I understand," Schneider said. "Tell me in your own words what you've found."

"It's all in the report, sir."

"I know," Schneider said. "Tell me anyway."

Knapp frowned. "Our Lunaville operation's been making more money than we've forecast. Sales're no higher than expected, but costs're lower. Ordinarily that'd be cause to applaud, but we haven't been able to find out where the savings're being made. Neither materials nor labor has had a drop in price. In fact, cost of labor's up."

"Streamlining operations?" William suggested.

"Maybe a little, sir." Knapp thought for a moment, then shook his head. "But that can't account for all of it. And nobody's applied for a 'creative solutions' bonus."

"So somebody's come up with a way to save the company money but doesn't want to be rewarded for it?"

"That's what it looks like," Knapp said. "Nothing really to worry about, but decidedly odd, and policy's to report anything odd."

Schneider nodded. "For good reason." He tapped at his computer's keyboard, calling up a graph, and swiveled the monitor so that Knapp could see it. "How do you interpret that?"

Knapp hesitated a moment before responding. "Accident rates? They took an upswing a couple of years ago. But, sir? Could I see the population figures for the same period?"

Schneider nodded, tapping at the keyboard again. A moment later another graph appeared, superimposed on the first.

"That's bad," Knapp said. "Population's been going up and you'd expect more accidents from that, but—not that much more."

"Now look at this," Schneider said. He typed again, this time adding a line for fatal accidents to the graph. While far below the other two, it rose even faster.

"I don't like the look of that." Knapp said.

"No more do I," Schneider said. "I'd just discovered the trend when I got your report. You gave me the clue I needed."

"I see, sir." His voice, however, sounded puzzled.

"Colin, somebody out there is either incompetent, or just plain willing to throw away lives for a little money. Either way I don't want him working for FTI. Part of analysis's job is to help me ferret out things like this."

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Knapp opened his mouth to say something then snapped it shut.

Schneider allowed himself a slight smile. "Thank you, Colin." He stood and held out his hand. "I'll take it from here."

"Yes, sir." Knapp took Schneider's hand, obviously relieved at the dismissal.

When the door closed behind Knapp, Schneider sank back into his chair and thought for a moment. He reached out and keyed the intercom. "Iris?"

"Yes, Mr. Schneider?"

"Can you get me on a flight to Lunaville? Today, if possible."

"Rush, sir?"

"As fast as you can get me there, but don't go so far as to charter anything."

"Yes, sir." A slight pause. "There's a ship leaving in three hours that can make the flight in two days."

"Thanks, Iris. What would I do without you?"

"Go bankrupt, sir."

"Too right. Thanks again, Iris."

Kristine swarmed up the ladder to the ambulance only slightly encumbered by the pressure suit she wore. The suit, one of the latest products manufactured by FTI, was one of the new active designs. Unlike many places she had worked, the Lunar ambulance service always kept its teams supplied with the very best equipment available. At least it had until recently.

She was the last one aboard. She slapped the switch that sealed the hatch, hitting the intercom button in almost the same motion. "We're aboard, Andy. Go."

Gently, despite their frantic haste, the ambulance lifted from the Lunaville landing field, accelerating at a smooth half *g*.

"What we got?" she asked her companion in the patient compartment, John Frakes.

"Doesn't look too bad," John said. "A fall. Tore his suit and leg. They got him into the emergency sack in good time."

Kristine nodded. Some bright construction worker had dreamed up that sack. Basically an airtight bag with a zipper seal and small attached air bottle. A person with a holed suit could be stuffed into it and thus saved. With more than a hundred construction sites and other small outposts scattered over the surface of the Moon, that edge was essential. Since the sacks' introduction a year ago it had saved more than a dozen lives.

A few minutes later, the ambulance went into free fall. Kristine took that opportunity to check the equipment, paying particularly close attention to the items they would need this run. The ground crews had gotten lax of late regarding restocking.

They were lucky this time. They had everything they were likely to need. Kristine breathed out a sigh of relief. She always felt nervous launching before making the check, but their prompt arrival could easily make the difference, more of a difference than fancy equipment and drugs.

The construction site that was

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their destination lay a good distance around the curve of the Moon from Lunaville. Their trip took almost half an hour at nearly orbital velocity.

"Stand by for acceleration," Andy said from the piloting compartment.

Kristine caught hold of one of the grab bars and made certain that her feet were on the deck. A moment later, weight returned as the rockets began to brake them to a landing.

At touchdown Kristine performed the three step sequence that opened the sealed door, three steps that could be performed quickly if needed, but that would not occur by accident.

Below them a small group of construction workers clustered around an inflated emergency sack.

"All set, Kris," John said behind her.

Kristine turned and saw that he had freed one of the stretchers from its wall mount. "Right," she said and clasped hold of the hand bar at her end.

Together, she and John wrestled the stretcher down the ladder. Its oversized wheels bobbed easily over the lunar dust.

"Here he is, Doctor," one of the construction workers said.

Kristine grimaced at that. No matter how many times she had tried to explain to these people, they insisted on calling her "doctor." She was not a doctor, she was an EMT.

"Make room," she said to the assembled construction workers as she wheeled the stretcher alongside the injured man.

"OK, John," she said. "Into the stretcher."

He nodded. Working together, they popped open the latches for the stretcher lid.

The stretcher had been specially designed for work in vacuum. It consisted of a tempered glass tube, hinged on one side and latched on the other. A person could be placed into it and brought under pressure far faster than they could be moved into the ambulance. To allow work to be done on a patient, a number of gloves of jointed metal plates protruded inward from the wall. The interior of the stretcher was already equipped with the most commonly needed supplies. An airlock at the head could allow others to be passed inside.

With the stretcher open, Kristine knelt at the head of the injured man so that he was between her and the stretcher. John knelt just below his hips. Kristine placed her right arm under where the man's helmet showed through the transparent material of the emergency sack and, with the other, reached across under his waist until her hand extended beyond. John placed his left under the man's knees and, with his right, grasped Kristine's extended left hand.

"On three," Kristine said. "One . . . two . . . three."

At "three" they lifted together and gently set the injured man into the stretcher. Still working as one, they slapped the lid shut and fastened the latches.

"Check or move?" John asked.

"He going to be all right?" one of the others asked.

Kristine looked up. The others had gathered around again.

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"Get back," she said, waving them away. To John, she said, "Check. I don't like the look of him. That's an awful lot of blood."

John nodded. "Gotcha." He stuck his hands into the gloveset at the foot of the stretcher and took the ripper from its bracket. Using the specially designed power tool, John trading off with Kristine when he reached the limit of reach of a particular set of gloves, the two of them quickly sliced open the emergency sack. The suit went next, exposing the body of the injured man.

"He's still bleeding," John said as the injured leg came into view.

"Get pressure on the wound," Kristine said. "I'll check the vitals."

Fumbling in the gloves, John managed to grab a gauze pad from the storage bin and pressed it against the man's torn thigh. It took both hands to cover the wound.

Kristine wrapped the blood pressure cuff around the man's left arm. She hit the switch to start taking readings while she strapped the 0_2 mask over his face.

"Pulse 125," she read, "BP 80 over 30. Respiration fast and shallow."

"Shit," John said. "He's going into shock."

"He's long past goin'," Kristine snapped. "I'm puttin' him on Ringers."

"Right," John said. Maintaining pressure on the wound as best he could with one hand, he selected an elastic bandage from storage. Blood flowed from under the gauze pad as he released it to begin wrapping the bandage.

"Pulse 130," Kristine read aloud as she felt for the vein with the IV needle. "BP 70 over 20."

"We're losing him," John whispered under his breath."

"No pulse!" Kristine nearly shouted.

John dropped the half completed bandage and jerked his hands out of the stretcher gloves. He shoved them into a set closer to the chest and, working with Kristine, attached heart monitor electrodes to the man's chest.

"Defib," Kristine said after a glance at the oscilloscope reading. She grabbed the paddles from their recess. "Three hundred joules," she said.

John set the machine. "Ready," he said a moment later.

Kristine pressed the thumb button in each paddle to squirt a small amount of electrode jelly onto the surface. She rubbed them together for a moment to spread the jelly evenly then placed the paddles against the man's chest.

"Hit!" she said. After a moment to give John a chance to be certain that he was not touching anything conductive, she pulled the discharge triggers.

"No good," she said a moment later when the oscilloscope still showed the squiggly line of fibrillation. John immediately moved to a position where he could begin CPR.

"Hit!" Kristine said. John pulled his hands away and she pulsed electricity through the man's heart again—without result.

As she dropped one of the paddles

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to reset the defibrillator for a stronger jolt she barely noticed Andy's arrival to take over CPR from John.

"Hit," she said. No effect.

While Andy continued CPR, John prepared the epinephrine needle. When John was ready, Andy lifted his hands to give him room. John placed the needle against the man's chest, just below the tip of the sternum. He pointed the needle down and towards the left shoulder then swiftly slid it in. After a moment's adjustment to make sure it touched the heart, he pushed the plunger home.

"No good," Kristine said. "I'm gonna hit it again."

John switched off with Andy. Kristine jolted the man again. Still nothing.

Schneider did not even wait for the airlock doors to fully open before squeezing through them and into the tunnel that connected the landing field with Lunaville proper. Almost immediately he felt pressure build up in his ears and worked his jaw to clear it.

As the other passengers filed out the lock door, Schneider again felt the pressure change and again he cleared his ears. Discounting the pressure changes as a result of the airlock's cycling, he started down the tunnel, falling almost immediately into the easy glide that worked best in the Moon's one-sixth gravity.

About a dozen steps down the corridor, Schneider again felt pressure in his ears. Again he cleared them.

The tunnel was designed as a series of metal tubes with sealed joints between them. The joints allowed some give for thermal expansion, settling, and even the rare moonquake—as weak as those were. Still, they represented a point of weakness.

Schneider stopped to examine one of the joints. The sealing material had cracked in several places. He could hear a faint, high-pitched whistle coming from the cracks.

Schneider could imagine what was happening. Slow leaks would bleed air causing pressure to drop slightly. Then the atmosphere control would pick it up and pump in more air. That would keep pressure oscillating slowly up and down. Only in the confined environment of the tube would the pressure change be noticeable.

"Is something wrong?"

Schneider jumped at the voice from behind him. He turned to see the owner of the voice. A man, mid-seventies was Schneider's guess, stood looking at him. The man's clothes practically shouted that he was from Earth—somber hues rather than the dazzlingly bright colors popular nearly everywhere in Exo-Terra, the space and Moon colonies.

Schneider flashed his cheeriest smile. "Isn't the construction of these things a wonder! I was just admiring it."

"Quite," the man harumphed and walked off.

Schneider sighed. There was really no danger of a serious pressure loss. Certainly there was no reason to alarm someone used to having air all around him all the time. Things were safe enough.

Schneider continued down the

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tunnel considerably faster than before.

"Mr. Schneider?" Someone addressed him as he passed through the pressure door that separated the tunnel from Lunaville proper.

Schneider nodded.

"I'm Sandra Quinn. I've been assigned as your escort."

"I see," Schneider said. "Tell me, Sandra, who's got the maintenance contract for the tunnel?" He nodded back the way he had come.

Sandra looked surprised. "We do, sir."

Schneider stared at her in shock. "*We* do?"

Thirty minutes after she had begun working on her patient, Kristine called it quits. "Damn," she said. "John, mark down the time of death. Let's wrap it up."

"What's next?" she wondered aloud to John as they wheeled the stretcher with its load back to the ambulance.

"Check your watch," he said, "Shift's over. We just take the ambulance back for the next team."

She blinked in surprise at the numbers reflected in her helmet faceplate. "I hate losin' patients," she said as they waited for Andy to lower the lift.

"Me too," John said. "If we could have got here just a little sooner. . . ." He shook his head.

"If we could have got here sooner, hell," Kristine said. "Simple *first aid* would have saved that man's life. If somebody could have just stopped his bleedin' before he lost so much blood, that would have made all the difference."

Silently, they caught hold of the lift cables to ride up with the stretcher. At the top, they swung it into the patient compartment. Once inside, they strapped the stretcher to its wall mounts.

Kristine palmed the hatch closure and intercom button.

"OK, Andy," she said. "We're all secure. You can take us back."

"Right," Andy said. He sounded as depressed as she felt.

To John, Kristine said, "We've got to do somethin' about our response times. How many people are we gonna lose for want of a simple bandage before we can get there?"

"I don't know," John said. "What can we do? Flight times are determined by laws of nature and there's nothing you or I can do to change them."

"I know, John. I'm upset, OK? On Earth somebody would have been able to stop that man's bleedin' before we even got the call. He'd probably still be alive."

"Well they can't do that here. Have you ever tried applying a bandage through a suit? Let alone one of the emergency sacks. It just can't be done."

Kristine bit back a retort. She realized that John was every bit as tired as she was, and every bit as upset at losing a patient. Fatigue and frustration put both their tempers on edge.

John seemed to echo her thoughts. He sighed and they waited out the rest of the trip in silence.

Kristine could see the next shift's team waiting as she climbed out of

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the ambulance. Below, workers had already begun to refuel and refurbish the ambulance's aluminox engines.

Andy had called ahead and a team from the coroner's office had come to collect the body. The second shift ambulance crew waited with a spare stretcher to replace the one they had used.

When one of the others approached to speak with her, Kristine waved him away. She was in no mood for conversation. Behind her, the coroner's team were already placing the corpse-laden stretcher into the lift to be lowered to the landing field. That stretcher would be emptied—Kristine tried not to think about that—sterilized, restocked, and placed back into stores for some team, perhaps hers, to use again.

Kristine had time to brood while cycling through the lock. It was a good thing she didn't drink, she thought, or this job would soon have her an alcoholic.

As the pressure rose in the lock her suit sagged. It always felt more cumbersome in pressure than in vacuum.

The inner lock hatch irised open to a scene of confusion and bustle far out of keeping with what she usually saw in the port facilities. She undogged and removed her helmet.

"What's going on?" she asked the nearest person.

"The boss is here," he said. "He's just come down on the last shuttle."

"The boss?" Kristine asked. "Mr. Conrad?" She had not known he'd been away.

"No. The *boss*. Mr. Schneider."

Kristine felt her eyebrows rise at that. While Conrad ran FTI's commercial operations at Lunaville, including the ambulance service although that was hardly a "commercial operation," Schneider, William Schneider, was the head of the entire corporation, a corporation that extended from Earth to the Moon and all the way to Troy at the eastern Earth-Sun Trojan point.

"What's he doing here?" she asked.

"Some kind of inspection," the man said. "Something's got him mad. Look. I've got to run. Can't talk now."

Kristine nodded at his back as he scurried through the crowd. She wound her way through the crowd to the locker room. Her medical insignia, boldly displayed on the upper left side of her chest, insured that the crowd parted before her.

"I heard it was bad," Alice Morrow said behind her as Kristine stripped off her pressure suit. She had already placed her helmet on the shelf and hung the backpack on the proper hook below it.

"Bad," Kristine agreed.

"Want to talk?"

Kristine turned to face her, suit draped over one arm. "No thanks. I just need to be alone for a while."

Alice smiled and nodded. "You got it. If you change your mind, you know where to find me."

"I'll remember," Kristine said. "Thanks." As day shift's dispatcher, Alice had appointed herself mother hen to the ambulance crews.

Alice hesitated than said, "This is a really bad time, but you have to know. Conrad sent down a memo. We can expect to have our budget

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cut again."

"What?" Kristine stared at her. "Is he insane?"

"Probably," Alice said. "He says our results don't justify the budget we've got." Alice looked thoroughly miserable.

Kristine leaned against the row of lockers and shook her head.

Alice patted her shoulder and vanished among the rows of lockers.

Showering off the stink and suit-smell felt wonderful—almost enough to make Kristine forget a man dead of blood loss.

Schneider's lip pulled into a progressively thinner line as he poked into various departments. Shortcut after shortcut had been taken. As soon as he had realized that his "escort" was leading him on a carefully guided tour to avoid the worst of the problems he had left her.

In warehouse 14A, Schneider stared in amazement at the wall. He didn't need tests to show that the weld in front of him, a weld in a pressure containing wall, was flawed. He could see it! Any halfway competent engineer would have screamed fits at letting something like that pass.

"Look out!" he heard someone call. He looked around. A forklift was bearing down on him.

Schneider dove aside, barely avoiding being run down. He landed badly, twisting his already weak right knee.

As Schneider pulled himself to his feet he saw the forklift continuing down the aisle as if nothing had happened. The driver wore a pair of headphones and his head bobbed in time to whatever he was hearing. The warning flashers were dark.

"Hey!" Schneider called. Ignoring the pain in his knee he sprinted after the forklift. Catching it he sprang up to the driver's cage and jerked the driver from the controls.

"Hey, what's wrong?" The driver said loudly. He probably could not hear himself under those earphones.

Schneider swept the earphones aside, feeling minor satisfaction as they bounced off the forklift to the floor.

"Hey!" the driver said.

"What do you think you're doing?" Schneider said.

"I'm taking a load of titanium plate to rack 22M."

"And you nearly ran me down."

"Really?" The man looked genuinely surprised. "Well, it was an accident, you know?"

"Accident? Right." Schneider drew a deep breath in an only partially successful effort to keep his temper in check. "And where are your warning flashers?"

"Warning flashers?"

Schneider's eyes ran over the controls. He spotted the switch he wanted and snapped it downward. Amber lights immediately began to blink. "Warning flashers." He said.

"Oh, those. They give me a headache."

"A headache," Schneider said. "I see. We can't have that. Tell you what. Why don't you report to the infirmary for some pain medication? Then you can report to unemployment. You're fired."

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"Hey! You can't do that!"

"Mr. Schneider, you all right?" The shop foreman bound up to them.

"I'm fine," Schneider said. "Although I'm a hair away from having this idiot arrested."

"Arrested?" The forklift operator yelped. "But I didn't do anything!"

"Oh?" the foreman said. "Want to gamble I can't find ten senior personnel who saw you try to run down Mr. Schneider? I bet I can."

"That won't be necessary," Schneider said. "*I'm* willing to bet that our friend here will quietly pick up his last paychecks and leave—immediately."

Schneider locked eyes with the forklift driver. Several seconds later the driver nodded.

"I'm awful sorry about that, Mr. Schneider," the foreman said. "That's the kind of jerk personnel's been hiring lately. I been using them as little as I can and some of the senior crew's been working overtime, paid straight at apprentice rate, but there's only so much. . . ." He shook his head. "Regs say I got to use everyone."

"It's all right. I see we've got a bad problem here and I mean to get it solved. That much I can promise you."

The foreman looked relieved. "Yes, sir. I can't say how glad I am to hear that."

Schneider nodded. "Look, I've got to go now. I want to look in on the ambulance service. If they're as bad as the rest of this. . . ."

"Sir?" the foreman said. "I'll tell you, they got some serious problems there, but I don't think they're at fault. Conrad's been riding them awful bad."

"That's about what I've come to expect," Schneider said.

Kristine saw somebody she vaguely recognized walk into the room while she was holding her post shift debriefing. A moment later the face fell into place—William Schneider, the boss. After a short nod in his direction she ignored him.

"Have either of you got *any* ideas how we might shorten response time?" she asked John and Andy.

Andy and John looked at each other and shrugged. A moment later, Andy said, "Only what you've thought about yourself. We need more ambulances and crews to run them."

"I hear you have a problem," Schneider said from the back of the room.

Kristine drew a deep breath. "Mr. Schneider, yes, we do have a problem." Despite her efforts to remain calm her voice rose slightly. "But if you know anybody who can do a better job I'd like to meet them."

Schneider raised his hands as though to fend off her anger. "Please. I'm not here to criticize your work. I'm looking for ways *I* can help *you*. You say you need more ambulances? How so? The reports that have reached me—" He hesitated a moment, "—say that two should be enough to serve a community this size."

"Reports," John made the word a curse.

Kristine nodded in agreement.

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"Those reports were based on Earth and Earth conditions, and even there I've never seen anyplace run that close to the wire. Things are different here. Most of our people are involved in heavy construction. In vacuum. There are lots of accidents. Each ambulance has four to six calls every day, and with travel times that can reach an hour each way; we barely have time to swap out used stretchers and replace expended supplies."

"And fuel," Andy said.

Kristine nodded, "A call came in today while both ambulances were out. A man died because of the delay."

"All right," Schneider said mildly. "I'll look into getting some more ambulances. And crews."

Kristine grimaced at that. She had heard businessmen promise to "look into" things before.

Schneider smiled slightly. "I see there's a problem here, one I should have known about a long time ago. I guess I'm partly to blame for that." He nodded. "Rest assured, though, I will take steps." With that he turned on his heel and left the room. Kristine noticed for the first time that he walked with a slight limp.

"Well, what do you think of that?" Andy said.

"I don't think much of anything," Kristine said. "Mr. Conrad said the same thing and *he's* planning to cut our budget.

"Now," she continued, "unless either of you had anything else to bring up, I think that does it."

"Don't think so," Andy said.

"Not me," John echoed. A moment later, when Andy had left the room, he said, "Join me in the commons?"

"Can't," Kristine said. "I've got to write up the report on that death."

"Yeah," John said. "Maybe later?"

Kristine smiled slightly. "Maybe. Tell you what. If I finish at a reasonable hour, I'll wander by the commons. If I see you, I'll join you."

"Deal!" John stuck out his hand with comic solemnity.

Grinning at him, Kristine took his hand then released it. "Get out of here."

Schneider leaned on the door buzzer again, holding it for several seconds before releasing it. He had reached a point where he would start beating on the door if the occupant didn't answer soon.

The door slid aside. A black man about fifteen years Schneider's senior stood in the doorway.

The man blinked sleep-filled eyes at him. "Will?"

"Can I come in, John?"

"Of course," John Millhouse stepped aside.

Inside, Millhouse led Schneider to the living room, then went to the kitchen. He returned a moment later with two cups of coffee.

"It's been a long time," Schneider said.

"It has," Millhouse said.

"How's your wife?"

"Splendid," Millhouse said. "She's just finished a graduate program in genetic engineering."

"The kids?"

"Tina's class is on a field trip to Farside station. Mark's just started

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school." Millhouse took a sip of his coffee. "Have you had enough time to cool down now? Care to tell me why you've really come?"

Schneider laughed. "Never could fool you, could I?" He sobered instantly and outlined for Millhouse what had brought him to Lunaville and what he had uncovered since his arrival.

Millhouse shook his head as Schneider finished his story. "I had heard there were some problems, but I never dreamed they were anything like that."

"As I see it, there's only one person who could have both arranged all this and kept word of it from reaching me."

Millhouse nodded. "Got cause to fire him?"

"Easily," Schneider said, "but that's *not what I want to do. I want to dig* up enough to prove culpability. I want him to pay for the injuries and deaths he's caused."

"So, why did you come to me?"

Schneider snorted. "The ambulance service."

"Pardon?"

"The rest I can handle myself, but the problems with the ambulance service have to be solved fast. I've got some ideas but they require engineering and you're the best engineer I know—" He grinned. "—even if you are retired."

"I'm not *that* retired," Millhouse said. "I still do consulting work."

"All right," Schneider said. "I'll hire you. Pay is whatever your standard rate is plus 50 percent. You can draw on any FTI resources you need, although I'd appreciate it if you'd use facilities at O'Neill rather than here, for obvious reasons."

Millhouse nodded. "Done. It's important then. Important enough to charter a fast courier?"

"Important enough to charter the entire fleet if you think you need it."

"No, just a fast courier. I'll probably want your O'Neill factories to run off the prototypes and ship them here."

William started to open his laptop computer. "You want to see what I had in mind?"

Millhouse shook his head. "From what you've said it looks like emergency first aid is the biggest priority. I've already got some ideas of my own I want to run with first."

"Whatever you think best." William stood and extended a hand. "Thanks, John."

Two weeks had passed since Schneider had arrived at Lunaville. So far the only effect Kristine had seen was a slight increase in the ambulance service budget instead of the expected cut. Alice had immediately used the money to hire four additional EMT's to spell others and to oversee restocking of ambulances. It did help to consistently have complete stock on hand.

Kristine woke late on her day off, her message recorder blinking at her. She reached across the bed and pushed the button.

"Ms. Aames," Schneider's voice came from the machine, "when it's convenient to you would you meet with me at my temporary office? I would appreciate it." An address fol-

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lowed. Kristine recognized it as being within FTI's local corporate offices.

With a groan she climbed out of bed. Despite the one-sixth gravity, she had to almost force herself to her feet. A quick shower, a light breakfast, and two and a half cups of coffee made her ready to face the world, or the Moon as the case would be.

The slidewalk took her to FTI's corporate compound. The receptionist at the front desk gave her directions to Schneider's temporary office.

"One moment, ma'am," the secretary said. She pressed an intercom button. "Mr. Schneider, there's a Kristine Aames here to see you."

"Send her in, please." Schneider's voice sounded tinny in the intercom speaker.

"He'll see you now." The secretary smiled up at her.

Kristine's eyebrows quirked upward. From her past experience with Conrad, she had assumed that businessmen kept people waiting as a matter of course, getting some perverse pleasure in proving that their time was more valuable than hers. The door opened even as she reached for the latchplate.

"Ms. Aames." Schneider's smile greeted her from the doorway. "Please, come in."

Kristine followed him into the office and took the seat he indicated.

Instead of the normal foldout that Kristine knew was installed in the desktop, Schneider used a portable computer plugged into the colony system via an interface cord. Next to the right-hand wall sat something that looked like a poorly designed vacuum stretcher. Instead of wheels, it had twin skids. Air tankage filled the lower half of the main cylinder, taking up the space normally occupied by specialized EMT equipment, drugs and solutions such as Ringer's. All that remained were the storage bins for bandages and the ripper.

She jerked her attention from the stretcher when Schneider spoke. "I've been working on your problems. I think we have some solutions."

He tapped at the keyboard of his computer for a moment. "First: I checked into the records of all the patients who died before they could reach the infirmary." He frowned. "In 80 percent of the cases prompt attention could have saved their lives." He slammed a fist onto the desktop. "Eighty percent! I should have known about this a long time ago."

"I—"

"I also found," Schneider said, cutting her off, "twelve reports, three of them above your signature, all saying just that—we need more prompt attention. All were buried, none forwarded." His hands tightened on the desktop until the knuckles turned white. "That goes beyond incompetence, beyond negligence, that's flat out criminal."

Kristine felt her eyes grow wide at Schneider's tirade. "Sir?"

Schneider shook himself and smiled at her. "That's not your problem. I just have a week or so's worth of details to handle before I can clean up. On more immediate matters, I've already contacted the shipyards at O'Neill and commissioned the construction of three new ambulances.

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I've also talked with personnel—at O'Neill, not here—and they're hiring eight more EMT's and four new pilots as drivers. That will let us keep three crews on call at all times and leave two extra ambulances that we can fill with off-duty personnel in emergencies."

"That'll help," Kristine said, "a lot."

"But it's not enough," Schneider said. "Is it?"

"Well." She paused for a moment. "It will help, but there's still an awfully long delay reaching some of the sites. Travel time. . . ." She shook her head. "What we really need is a way for people to perform first aid before we get there. That would do more than anything else to save lives."

Schneider nodded vigorously. "My thoughts exactly. I had these cooked up." His gesture took in the stretcher. With three gliding steps he stood beside it and beckoned her over.

The shell and gloves were identical with the standard vacuum stretcher. Schneider opened it and pointed out interior fixtures. "We're making a modification in the emergency sacks. The zipper extends farther on the new model so you can unzip, work on the patient in here. Then, if you need to, you can rezip, reinflate, and take him out of the stretcher to use it to treat someone else. The air supply can handle dozens of reuses."

Kristine poked into the stretcher's built-in supplies. Bandages, splints, respirator, all the items that an individual trained in first aid could use. The ripper would let them cut through the suit, even if they no longer needed to treat the emergency sacks that way. She noticed one thing. "You'll have to install some kind of heart rate monitor," she said. "Can't take a pulse with those gloves."

Schneider nodded. "All right."

"Still," Kristine said. "I'm impressed. This is just the thing."

"There's more," Schneider said. From under the stretcher he drew a cloth bundle attached to a small air bottle. "The Mark I Portable Pressure Shelter. It inflates to a seventeen-foot cylinder, eight feet in diameter. Built-in hammocks let it hold twelve people at a time. An airlock at the end is large enough to accommodate a stretcher and a crawling suited individual, or three crawling suited individuals, at once. The tanks can only inflate it once, but it can tie into a crawler's air system." His smile faded. "I hope we never need it, but I'd rather have the ability to handle a lot of injuries at once and not need it than . . ." He let the idea trail off.

A moment later he added. "You would have had this stuff a year ago if I'd known about your problems then."

"How soon?" Kristine asked. "How soon can we have it?"

"It will take a few months to complete the new ambulances, but these," he waved at the stretcher and portable pressure shelter, "we can start putting in place in just a few days."

Kristine stepped off the lower rung of the ladder to the cargo hopper. "Thanks, Jake," she called to the pilot.

"No problem," Jake's voice came

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from the piloting chamber of the hopper over her suit radio. "Pickup in two days?"

"Right," she said.

Without exception, she and the other EMT's had volunteered to spend their days off training the various construction crews in using the new vacuum stretchers. Each crew would be equipped with one stretcher for each five personnel, and one portable pressure shelter for each twenty-five. The cargo-hopper's hold contained the stock for this crew.

"Ms. Aames?"A man whose suit carried the insignia of a foreman approached her.

"Here." She raised a hand to identify herself.

"We were told you'd be coming," he said. "I hope you'll excuse us. We're not really set up for visitors. Besides, we're shorthanded at the moment. Mr. Schneider's fired half my crew."

Kristine hesitated for a moment. She wanted to defend Mr. Schneider but settled for saying. "I'm sure he had reasons."

"Oh, I know he did. What he fired was the worst bunch of slackers and incompetents. But it kind of leaves me stuck for bodies."

Kristine smiled, hoping he would be able to see it through her bubble helmet. "Well, I'm not exactly a visitor. I'm going to run your crew ragged teaching them first aid."

"You're welcome to try, of course," he said. "I don't see what you can do. I have first aid training myself, but you can't work through a suit."

"We've got some new equipment to take care of that. But first, do you have the new emergency sacks?"

"Yeah," he said. "It seems a stupid modification if you ask me. What good does it do to be able to reseal a sack? You can't do anything useful before your patient drowns in vacuum."

"You'll see," Kristine said.

He nodded. "If you say so. By the way, name's Wayne."

"Call me Kris."

She set up her classroom in the central construction shack. While pressurized, it was fifteen minutes from the nearest work site by crawler—an hour and a half from the farthest.

The construction workers, coming off shift, filed into her makeshift classroom and took seats.

"This," she said when the last of them had sat down, "is our new emergency first aid unit." She indicated the vacuum stretcher behind her. "It will allow you to perform the most important three items in emergency first aid." She counted on her fingers. "Insure the breathing. Stop the bleeding. Treat for shock. Thanks to the new emergency sack design, you can now reseal a person when he is out of immediate danger and remove him from the unit so that it can be used for others."

She smiled. "Some of you may want to go on with CPR training, maybe even EMT training."

"Excuse me, ma'am," one of her new students said. "But what's 'EMT training'?"

"Emergency Medical Technician."

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She tapped her chest. "Like me. It's a little more involved here on the Moon than it usually is on Earth. We're often out of radio contact with Lunaville and have to make decisions that would normally require a doctor's OK." She opened the stretcher. "Now, let's get to work."

For the next six hours she drilled her students in bandages, in direct pressure to stop bleeding, in use of the respirator mask, and in splinting broken bones. They practiced both on the floor of the shack using each other as practice victims and working with the gloves in the stretchers. By the time she called a halt to the class Kristine was as tired as her students, notwithstanding their having worked a full day before class had even begun. Still, she had already found several who had proven quite adept at the difficult task of working through the gloves with the stretcher under pressure.

Schneider sat back in his chair and rubbed at his temples. His head throbbed in time to his pulse but it had been worth it. About half of the "cheap labor" that Conrad had hired were gone, and the newly swept clean personnel department was taking care of the rest. There was only one more target for Schneider's personal attention and that would wait for tomorrow. He had built an airtight case, criminal negligence, fraud, embezzlement. He might even be able to get the "accidental deaths" parlayed into some kind of murder charge. He'd have to talk to a lawyer about that.

The door buzzer sounded, breaking into his thoughts. "Come," he said.

"Busy, Will?" Millhouse peeked in the half open door.

"Not any more," Schneider said. "I've about got it wrapped up."

"You really took this personally, *didn't you?*" Millhouse stepped through the door and dropped into a chair.

"It is personal. Dad never wanted his company to be turned into this kind of slipshod operation."

" 'Like father, like son,' huh?"

Schneider grinned. "I try."

"Why don't you get some rest?" Millhouse said. "He'll still be there tomorrow."

"Tomorrow, yes," Schneider said. His grin was vicious. "But not the day after."

"I guess you did have something to show us," Wayne said the next morning.

She just smiled.

"Look," he said. "There's no reason why you need to be cooped up in here all day. Why don't you come out to the site? I can show you around and introduce you to the crew. You can see what we do."

"Sounds great," Kristine said. "If you're sure I won't be in the way."

"If you're in the way," he said with a sharp nod, "you'd better believe I'll tell you. Ask any of my junior personnel if you don't believe me."

"All right," she said. "Let me get my suit."

Outside, Wayne introduced Kristine to the driver. "This is Bobbi. She

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rides herd on this monster."

"Monster?" Bobbie sounded affronted. "This is just a big pussy cat." She patted the tread affectionately.

"Monster I said and monster it is," Wayne said. "I've tried to drive one myself."

"Can't help it if you're all thumbs and clubfooted, boss."

Wayne laughed, which surprised Kristine. Somehow, she had never expected that kind of joking would be popular out here.

"Look, Bobbi," Wayne said. "Kris here's going out to the site with us. Mind if she rides topside with you?"

"Be my guest," Bobbi said. "Always room for one more."

Kristine followed Bobbi up the ladder to the control station on the crawler's roof. A quick glance to the rear showed her five new stretchers secured atop the crawler.

Once in position, Bobbi gave her a very thorough lecture on everything she was not to touch, not to even look at cross-eyed.

A few minutes later the rest of the work crew climbed into the back of the crawler.

"Isn't the crawler pressurized?" she asked Bobbi once they started moving.

"Nah," Bobbi said. "Can't. We move cargo in and out of the back too much. The whole back wall opens out to make room for the big stuff. Sealing would be a problem if we tried, never mind trying to recover the air before opening the back. It's just not worth the effort." She glanced over her shoulder at Kristine.

"We do have one pressurized compartment," Bobbi added. "We call it the lunchroom. Seats one and only just. You open the hatch and step over the seat with a kind of crouch-wriggle in order to take your place. The hatch bumps your backpack in closing. The far wall is practically in front of your face. Your helmet brushes the ceiling and there's no room to wiggle your elbows." To illustrate, she wiggled her elbows. "I hate it, but it does give you a place to eat."

A moment later, she said, "Look, we're headed to site twenty-three, the far one, so you might as well get comfortable and enjoy the scenery."

"Is that a polite way of telling me to shut up?"

"Not at all," Bobbi said. "Chit-chat all you want."

"FTI O'Neill," Schneider heard as the face appeared in the screen. "How may I—" The face's eyes opened wide. "Mr. Schneider! How may I help you, sir?"

"Can you connect me with accounting?"

"Yes, sir," the answer came after the three second speed of light lag time.

Schneider sat in Lunaville's central communications center. The communications technician he had ousted to take the panel stood on the other side of the room, whispering with one of his colleagues, no doubt wondering if he was going to be one of the people Schneider was going to fire. As luck would have it, he was not. Schneider had decided the man suffered from nothing worse than a

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severe case of tunnel vision about his job; he had not even been aware of the problems in Lunaville.

"Accounting," a new face appeared on the screen.

"This is Schneider," he said. "I've about finished here, but we're going to need a complete audit. I need to know how much this fiasco is going to cost us soonest. How soon can you get a team here?"

"Travel time plus twelve hours," the person at the other end said.

Schneider nodded. "Fine. Get together what you need. If you have any problems, contact me here immediately. I don't care what time it is."

"Yes, sir."

Schneider shut off the screen and stood up. He turned to the communications technician. "It's all yours."

"You mean I still have a job?"

Schneider smiled. "Yes, you still have a job. Contrary to rumor, I'm not firing *everybody*."

The relief was obvious in the man's face. Schneider clapped him on the shoulder as he returned to his seat.

"You mind if I hang around for a while?" Schneider asked. He did not really need permission, but it never hurt to be polite. "I'd like to see how things work here."

"Sure," the man said. "But it's pretty dull."

Schneider nodded and took a position in the rear of the room, out of the way.

After a long, bumpy ride the crawler rolled into the half completed excavation. Wayne met Kristine at the foot of the ladder.

"What are you building here?" Kristine asked.

"This ought to interest you," Wayne said. "It's going to be a search and rescue hub. We've still got a lot of the Moon to explore, but we can't even begin until we've made arrangements for emergencies."

"Explore?" Kristine asked. "What's to explore? We've seen all of it. Haven't we?"

"From orbit, sure," Wayne said. "But not like this." He stooped and picked up a handful of Lunar soil and let it run through his fingers. "Up close and personal. We won't really know the Moon until after we've tramped all over its face. Long after."

"Why, Wayne," Kristine smiled up at him. "I never suspected you for the pioneering type."

He grinned back at her. His wave took in the entire horizon. "I'm here, aren't I?"

Kristine laughed, having no answer.

For the next hour and a half Wayne introduced Kristine to the others. He explained how construction would proceed. They had already blasted a level place to provide a landing field. Currently they were excavating a pit that would contain the station proper. Once they had completed the excavation they would erect within it a steel dome to contain the atmosphere. A thick layer of heat-fused glass blocks would go over that and finally they would cover all with a ten meter thick layer of lunar soil. Alongside the field they would build several aluminum quonset huts and cover them with layers of lunar soil to act

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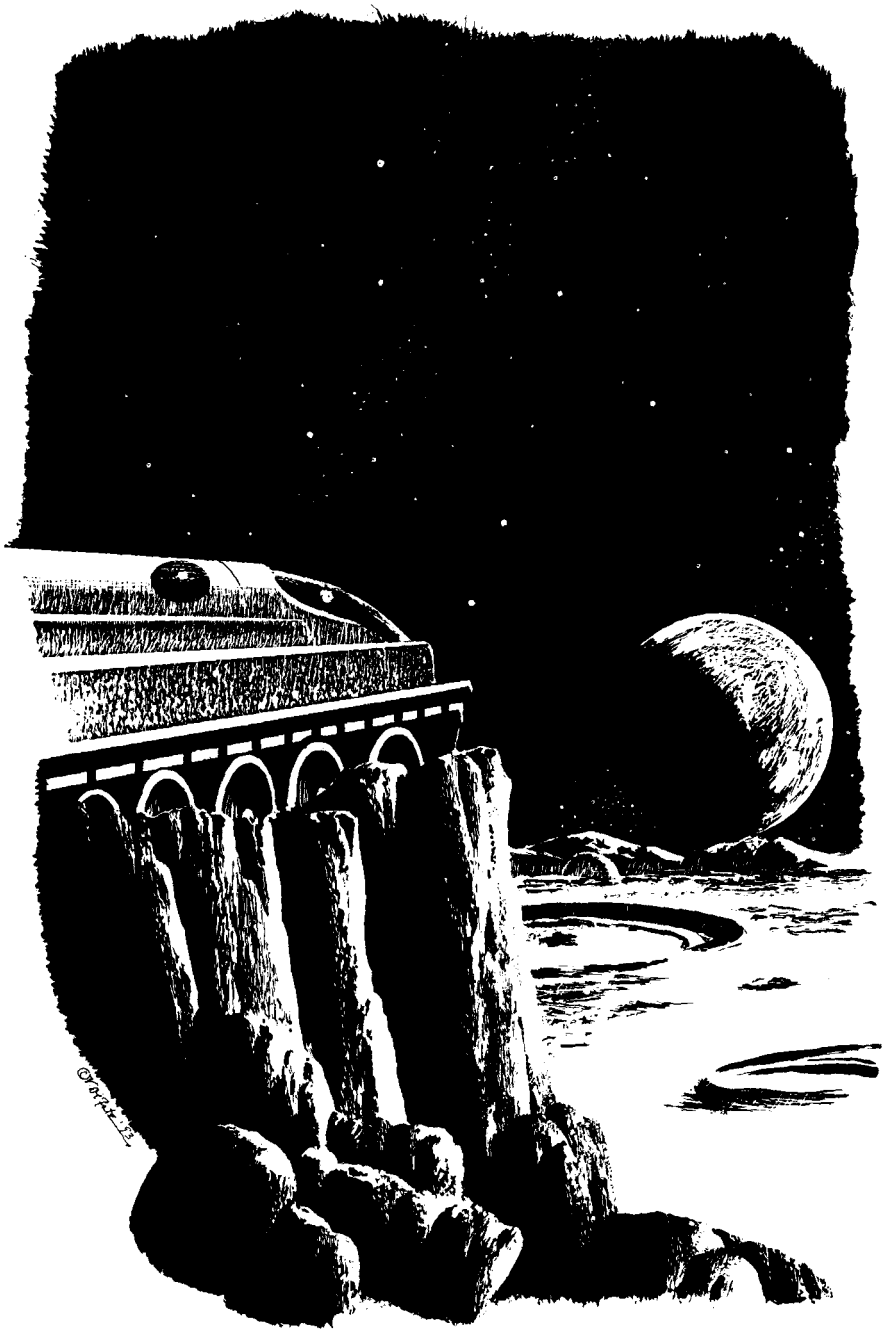

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as hangars and fuel storage areas.

"You'd better go back to the crawler," Wayne said at last. "We're about to set off the charge. Nothing really dangerous, but our insurance won't cover us if visitors are close by."

"All right," she said.

Bobbi awaited her at the crawler. "He give you the big insurance speech?"

"I guess," Kristine said.

"Well, he's right," Bobbi said. "The insurance people are real sticklers for that sort of thing. I guess they think you'll stick your nose right in the borehole or something like that."

In eerie silence the blast threw a small mound of rock into the nonexistent air.

"What the—" Bobbi jerked around in her seat, staring at the blast site.

Kristine followed her gaze. The ground was collapsing in an ever expanding circle around the blast. Men dropped whatever they were holding or leaped from their machinery and ran. Despite their efforts the circle of destruction caught up to them and they fell into the spreading pit.

The circle reached the crawler. It tilted to the side then dropped from under them. Kristine felt herself falling for an absurdly long time.

"So these two stations," the communications technician said to Schneider, "handle all our communications with field sites, as well as off planet message traffic, at least what doesn't go by commercial carriers."

"Just two stations?" Schneider asked. Schneider looked around the room. More than a dozen stations were occupied with about half that many empty.

"Just two are *ours*," the man said. "It can get hectic at times, but mostly we're automated enough that it's plenty. When we do get hit we work with some of the other ops. It's one big family here."

"I see," Schneider said. "What about—"

"Just a minute, sir," the communications technician said. A light had started to flash on his console. He typed at the keyboard. "We've just lost the beacon from Aristarchus West, site twenty-three."

"Is that bad?" Schneider asked.

"Probably not," the communications technician said. "We have a lot of minor failures. They'll probably be back on line in a half hour or so."

"And if they're not?"

The communications technician looked back over his shoulder. "It could be as simple as a transmitter failure, or it could be a major disaster."

Schneider felt a chill. "What's the quickest way to check on them?"

"By ship, I guess. But assuming a ship's available they're still better than a half hour away. We'll probably hear from them before one can arrive."

"Excuse me."

Schneider turned at the sound of the voice. A man sitting at a station belonging to LunaSat Corporation faced him. "Yes?" he said.

"Did I hear right? You think you might have a bit of a problem around Aristarchus?"

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"Maybe," Schneider said.

"Well, it so happens we have a survey satellite that will be passing over there in a few minutes. We can nudge the resolution and take a peek if you think it will help."

"That's great," Schneider said. "It's probably a waste of time, but—"

"But there's no harm in looking, is there?" The man turned back to his console.

Kristine did not know how long she lay dazed. When she could think clearly again she sat up. The crawler lay next to her, tilted half onto its side. Rubble covered the downward side, partially burying it. Bobbi still sat in the driver's seat, held in place by her safety webbing. Kristine could see her shaking her head within her helmet.

"What happened?" Kristine asked.

"Dunno," Bobbi said. "I've never seen the ground drop away like that."

Bobbi pointed beyond Kristine's shoulder. Kristine turned to see someone climbing over the broken rubble, approaching them.

"Miss," the man, Kristine remembered his name was Robert Carter, said when he came close, "what should we do? We've got injured people out here."

Kristine shuddered. To Bobbi, she said, "You'd better call for the ambulances."

"Can't," Bobbi pointed to the rear of the crawler. "Antenna's smashed. Of course that also knocks out the beacon so they'll know we're out of touch. Don't know how long it'll be before they come looking."

"Damn," Kristine whispered. Louder, she said, "How many able-bodied men have you got?"

"About half. They're back that way trying to get those that have suit ruptures into their emergency sacks."

"Exactly right," Kristine said. Wryly, she added, "First, insure the breathing."

A second later she looked towards the rear of the crawler. One of the stretchers was shattered, but the others seemed to be intact. "Help me with this," she said and began to unfasten one of them. It was not heavy, not in Lunar gravity, but it was awkward. With it free, she paused for a moment to release the portable pressure shelter.

"Bobbi," she said, picking up one end of the stretcher, "Set up the shelter. We'll probably need it,"

"But," Bobbi said as Kristine and Robert started off with the stretcher between them, "how?"

"Directions printed on the outside," Kristine called back.

As Kristine and her helper topped a ridge of broken rock the scene of destruction came clearly into view. Four men lay visible in sacks. Two men were stuffing a fifth into another. Three other men lay unmoving, one half buried in rubble. Of the ten or so still moving around, two did not seem well. One walked in a dazed stagger, even allowing for the uneven terrain. The other crawled, dragging one leg limply behind him. He crawled towards the half-buried man, apparently intent on helping dig despite his own injured leg.

Kristine shook her head. "Let's get

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to work."

A piece of rock, shaped like a long railroad spike, had pierced the shoulder of the first person they reached, a woman named Rachel.

Kristine swallowed a lump in her throat before directing Robert in helping her lift Rachel into the stretcher. She knew that it shouldn't matter that she knew her patient by name, but it did.

"Grab somebody and go get the other stretchers," she told Robert.

Kristine unzipped the emergency sack and cut free Rachel's suit. The wound did not seem to be bleeding heavily, but that would be largely because the rock still plugged it.

"I need a hand over here," she said.

"Right here," someone said. Kristine looked up and recognized his face, Todd Peige.

"I'm gonna remove that rock. I want you to take a gauze pad and press it against the wound. Press *hard.* You keep that pressure on while I go check on somebody else."

"Yes, ma'am," Todd said, his face white.

"Good man. Ready now." She took hold of the rock, watching her hands at work carefully because the double layer of gloves made it impossible to feel anything. With a steady pressure, she eased the rock out of the wound. As it came free, blood spilled out, spattering the inner wall of the stretcher. Todd paled even further.

"Todd, pressure," Kristine said, her voice calm.

He jerked and slapped the gauze into place, leaning heavily on it. "Sorry."

"It's OK," she said. "Keep the pressure on it."

He nodded.

The next one did not have any suit damage. A blood smear marked his faceplate and blood flowed slowly from his nose which appeared to be broken. He did not appear to be breathing.

She glanced up to see two men approaching her with a stretcher. "Here," she called, waving her arm. The men brought the stretcher to her and, with their help, she got the injured man into it.

Kristine unfastened his helmet first thing. Tilting his head to the side, she scooped into his mouth with her right index finger, sweeping across and out of his mouth. Her finger came out bloody.

While the others went back for another stretcher, she strapped the respirator mask to the injured man's face. The red light glowed, warning that no air was reaching her patient's lungs.

With a curse, Kristine ripped off the mask and turned the man's head to one side. With the ripper, she tore a section out of the front of his suit. Placing the heel of her left hand below the sternum and her right hand on top of it, she leaned sharply downward. With a cough, visible if not audible, the man spit up a mouthful of blood then took a huge shuddering breath. An instant later, he began breathing normally.

"I do believe we've got it this time," the man from LunaSat said. Swiftly, line by line, a picture formed

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on the screen.

"Oh . . . my . . . God," Schneider breathed as the picture cleared. A scene of disaster faced him. He spun to face the FTI communications technician. "Get the ambulance service. I think we're going to need both of them. Also get any ship available ready to carry a rescue team.

"Yes, sir," the communications technician hastened to comply.

"Oh," Schneider added, "have the first ship available hold a seat for me."

The communications technician hesitated then said, "Yes, sir."

Nearly two hours after Kristine had begun, she had stabilized the worst injuries and gotten them into the pressure shelter. With that taken care of, she helped the others in searching for the last two missing crewmembers, one of them Wayne. So far, she had lost two patients. One had not gotten into the emergency sack in time. The other had had a broken rib driven into his lung. He had bled to death internally.

"Bobbi's watching the people in the shelter," Todd said. "She's had first aid training Earthside so she can keep an eye. She says she'll call if anything goes wrong."

"Good." Kristine stooped to shine a light into a crack, hoping to catch a glimmer of suit material.

"I've got someone!" the call came from across the field.

Kristine almost dropped her light in her haste to reach the source of the call, Todd right on her heels.

"Somebody bring up a working dozer," the one who had called said. "We've got to drag this boulder off of him."

"I'm on it," Todd said and ran off. A moment later he returned, backing a dozer near. With Kristine's willing help, they wrapped heavy nylon line around the boulder and tied it to the tow-fitting on the dozer.

The dozer crept forward. The boulder slid, then rocked, then tumbled free. The moving boulder uncovered two legs. Two left legs. Both of them kicked as they came free.

"They're alive!" Kristine did not see who grabbed her and swung her around.

The rescue ship arrived shortly thereafter, followed closely by one of the ambulances. With more willing hands attached to able bodies they were soon able to free both of them.

Once free and checked for injuries—mostly minor bruises—Wayne sat up in the shelter and said, "Martha, you know I've always wanted to be lying next to you, but that was a little extreme."

Martha, the one who had been trapped with him, scowled for a moment, then grinned. "Oh, blow it out your ear, boss man."

Kristine just grinned as she sagged against the wall at the end of the shelter and slumped to the floor. Fatigue had caught up with her at last.

John Frakes, her usual partner, entered through the airlock at the other end of the shelter.

"Rough?" he asked, taking a seat beside her.

"Rough," she agreed.

"I heard you lost two."

She nodded, then gestured around

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the nearly full shelter. "But we saved more."

Schneider crawled through the airlock into the pressure shelter. He had seen the damage done by the collapse, but the emergency crews seemed to have it well in hand.

Inside, he saw two of the EMT's sitting against the far wall. The hammocks were mostly filled with the injured, both serious and minor.

Schneider popped open his helmet. "I was told that the foreman was in here?"

One of the less seriously injured raised a hand. "That's me."

Schneider stood at this side. "How bad was it?"

"Bad enough. We lost two, more will be in the hospital for some time."

"They'll get the best of care, I can promise you that."

"Excuse me, but I've heard promises before."

Schneider's brows knit. "Maybe, but you've never heard *me* make one." He changed the subject. "Any idea what happened?"

"Not quite sure, but I think there was a gas bubble under the area. Our blast ruptured it and it collapsed under us."

"A bubble? Wasn't this area surveyed before you began work?"

Wayne's laughter was devoid of mirth.

Schneider nodded knowingly. How much more would they pay for the mess that had brought him to Lunaville?

Out of the corner of his eye, Schneider saw someone approaching. He turned to face her.

"Mr. Schneider?" It took a moment for Schneider to place her face, Kristine Aames.

"Ms. Aames?" Schneider nodded in greeting.

"I wanted to thank you, sir. If you hadn't gotten that new equipment. . . ."

Schneider shook his head. "Thank *you.* If you hadn't brought the problem to my attention this would have been a disaster. No, it's already a disaster. It would have been a catastrophe."

Kristine nodded.

Schneider thought for a moment. "I think it's time I wrapped this up." He thought a moment more. "The ambulance service has paid most heavily for this fiasco. Want to be in at the finish?"

Kristine looked around, obviously tempted. "I've got work—"

"Go on, Kris," the other EMT in the room said. "We have two crews on site. We can handle it from here."

Kristine nodded. "All right. Thanks, John."

Schneider had told Kristine specifically *not* to clean up or change. She had had a scrape on her forehead, and a bloody nose, looked at in the infirmary. She hadn't even known that she'd been hurt.

Schneider looked her up and down when she left the infirmary, nodding in obvious satisfaction. "Perfect," he said.

Kristine noticed the other three men with him. Two of them were from Lunaville security. The third

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was a full captain from the Protectorate fleet.

They started at a brisk pace. Kristine struggled to keep up until Schneider noticed her difficulty.

"Are you all right?" he asked.

"I'm sorry, sir," she said. "I'm just so tired."

"No, Kris, I'm sorry. I just wasn't thinking." He turned to one of the security men. "Officer, could you run back to the infirmary and get a wheelchair for Ms. Aames?"

"Yes, sir," the security man trotted back down the corridor.

"That's not necessary!" Kristine protested.

"Humor me?" Schneider turned eyes so soulful on her that she almost laughed.

A moment later, the security officer returned with the wheelchair. Schneider waved her into it.

Schneider himself wheeled Kristine down the corridor. They arrived at Conrad's office.

"I'm here to see Mr. Conrad," Schneider told the receptionist.

"I'm sorry, sir. He's not available right now."

"He's available for me," Schneider started to push past her.

"Sir," the receptionist stepped in front of the door. "You can't go in there."

"On the contrary," Schneider said. Over his shoulder, he said, "Officer?"

"Ma'am, will you step aside, please," the security officer who had brought the wheelchair said.

"But—"

"Ma'am, I must insist."

Slowly, the receptionist stepped aside.

"Don't touch that!" Schneider snapped as the receptionist reached for the intercom button.

Schneider reached over Kristine's head to slap the door aside. He pushed her through the doorway.

"What is the meaning of this!" Conrad stood up behind his desk.

"I think you've forgotten just who works for whom around here," Schneider said. "Trying to keep *me* out of your office?"

"But . . . but . . ."

"It doesn't matter," Schneider said. "As of this instant you no longer work for me."

"You can't do that! I have a contract!"

"Are you really that stupid? With what I've found in the past three weeks you're lucky I don't just toss you out an airlock."

Conrad acknowledged the security personnel for the first time. "You heard him! He threatened me!"

"Really sir?" one of the officers said, affecting surprise. "Are you sure? All I heard was a politely worded notice of termination."

"Tell me something, Mr. Conrad," Schneider said. "Did you even have a survey done at Aristarchus west?"

The change of subject threw Conrad off track. He took a moment to recover. "Nothing ever goes wrong on those projects, and surveys are so expensive."

"Nothing ever goes wrong?" Schneider laid a hand on Kristine's shoulder. "Well something did this time. They had a collapse that nearly killed the entire crew. This young

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lady was there and it's a good thing she was. Otherwise we would have lost a lot more than two."

Conrad looked down at her, as if seeing her for the first time. "I don't see—"

"No, I don't suppose you do," Schneider said. "He's all yours, officers."

One of the security officers stepped around Schneider and Kristine. "Sir," he said to Conrad. "I hereby place you under arrest on the charges of fraud, embezzlement, reckless endangerment, and manslaughter."

"What? But . . ."

Schneider wheeled Kristine out of the office. "I'm sorry about that," he said. "I wanted you along because I wanted to rub his nose in what he's done. Childish of me."

Kristine did not know what to say so she said nothing.

"I also should apologize for what you've gone through since Conrad's been in charge here. I should never have let this happen."

"But, sir," Kristine said. "It's not your fault."

"No?" Schneider said. "Well, maybe not, but this is my company. That makes it my responsibility. Damn, how many more time bombs are out there, like that survey that was never done."

Kristine shivered at the intensity in his voice. "What are you gonna do, sir?"

"Do? There's not much left that I can do. I'll just clean up the mess as best I can and try to find some way of keeping it from happening again."

"Kind of like an EMT," Kristine said.

"Pardon?"

"We get handed the worst messes that used to be human beings and have to patch them together the best way we can. It seems you're trying to do much the same thing."

Schneider laughed. "Like an EMT. I like that." ■

Some books are to be tasted, others to be swallowed, and some few to be chewed and digested.

Francis Bacon

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THE REFERENCE LIBRARY Tom Easton

Vanishing Point, Michaela Roessner, TOR, $21.95, 382 pp. (ISBN:0-312-85213-4).
Harvest of Stars, Poul Anderson, TOR, $22.95, 395 pp. (ISBN:0-312-85277-0).
The Hammer of God, Arthur C. Clarke, Bantam, $19.95, 226 pp. (ISBN:0-553-09557-9).
Warstrider, William H. Keith, Jr., Avon, $4.99, 340 pp. (ISBN:0-380-76879-8).
Against a Dark Background, Iain M. Banks, Bantam, $5.99, 517 pp. (ISBN:0-553-29225-0).
Split Heirs, Lawrence Watt-Evans and Esther Friesner, TOR, $18.95, 319 pp. (ISBN:0-312-85320-3).
Once Around the Bloch, Robert Bloch, TOR, $22.95, 406 pp. (ISBN:0-312-85373-4).
Technology and the Future, 6th ed., Albert H. Teich, ed., St. Martin's Press, $16.00, 385 pp. (pb) (ISBN:0-312-08953-8).

I wonder how many times science fiction writers have asked themselves "What if some large portion of the human species disappeared overnight?" The earliest example I recall offhand was Philip Wylie's *The Disappearance* (1951), when women and men vanished from each other's ken. There have been others, too, and each and every time they have failed to support their own weight as SF—there simply isn't any way to justify the event logically. Even if one supposes alien evildoers, there is no purpose that the event serves within the story that could not be served more sensibly in some other way.

Such stories are necessarily fantasy, which is not to say they are not worth writing or reading. Wylie, for instance, was commenting on the war between the sexes, and his story is quite deservedly a classic. But it ain't SF, for its central event gains its rationale only by reference to a context entirely outside the story itself.

Can Michaela Roessner make a similar claim? Her latest novel, **Vanishing Point,** is set decades after the "Vanishing," when most human beings disappeared. Wives and children and friends and neighbors simply were not there when the survivors woke up one morning.

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Certainly the logical failure is there: She seems to say everyone vanished simultaneously, worldwide, without witnesses or warning, without realizing that when it's night *here*, it's day *there*. And when she gets around to offering explanations, the one she seems to like best involves black holes; she doesn't seem to know that black holes can't take just people.

So the novel can't stand up internally. Is there some external framework for it? Perhaps not, at least beyond the "Oh, what a nifty gimmick" level.

Yet—despite my curmudgeonly quibbling and caveating—if one accepts Roessner's premise, her story moves quite well, beginning with an arsonist who is convinced that some abandoned houses have been "infected" by something mysterious and threatening. The evidence is abandoned paint cans labeled with colors such as Maganda', Strangury, and Croze, books with unknown titles, and other strangeness. To save the world and prevent another Vanishing, he purges the houses with fire, always taking great care that the flames not spread into the dry Southern California scrub surrounding them.

This establishes the mood of strangeness and madness. People are coping, but not always well. Among the best are those who live in San Jose's Winchester Mansion, long famous for its owner who kept carpenters working all her life, building rooms upon rooms upon rooms, complete with staircases that went nowhere. Here we find Renzie, Tuck, Hammer, the Krit, and many more, including children with strange talents. Nearby are the old theaters, now the Domes of the Watchers, who never do anything without others watching; they believe this will protect them from a second Vanishing. The Homers carefully maintain the Homes from which their loved ones Vanished; they are sure wives and husbands and children will someday return as mysteriously and suddenly as they left. Not too far off is Silicon Valley, where a remnant of the old-time scientific community struggles to figure out what happened and impatiently awaits the arrival of a fellow academic with grand ideas from the East Coast. In the hinterland are a thousand cults and sects, including the 'Bounders, who believe it their mission to exterminate everyone else.

The East Coast academic, Nesta, arrives and soon organizes a research effort that—because it focuses on anomalies such as those paint colors—scandalizes the local academic bureaucracy. Shortly thereafter the 'Bounders are caught spying; they appear to be planning an attack. Tuck is having trouble with his love life. Renzie, full of anger, is having trouble finding one. The kids are getting weirder. And the anomalies are becoming numerous and blatant enough to make it very clear why one sect has declared surrealist René Magritte a saint.

In the end, weird kids and surrealistic world-shifts prove key to solving the problems of both the 'Bounders and the arsonist. And though there is

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no assurance that the world will ever be stable again, the characters do find in their situation the hope of happiness.

Perhaps this is the external lesson or moral that lets the story stand: No matter how unruly life becomes, there always remains that potential, that hope, and it is best pursued by embracing chaos.

It's no wonder us stodgy rationalists look a bit bilious.

Poul Anderson's **Harvest of Stars** is something of an oddity in structure, for it begins with its epilogue and a glimpse of love that endures until the end of the worlds. Once it has thus piqued our curiosity, it shows us Kyra, a space pilot on Earth for a bit of R&R. She is desperately dodging the forces of the central-statist Avantist tyranny, aiming to rescue her boss, Anson Guthrie, from those who would force him to surrender control of the corporation he founded, Fireball, of the wealth and power of space which Fireball monopolizes, and of the loyalties of Fireball's thousands of "consortes." Soon we learn that Guthrie died many years ago; he continues as a "download," an electronic duplicate tied to a specific hardware box; there is only one copy, the one that rode a probe to Alpha Centauri and returned with reports of sparse life and an imminent planetary collision. It is in dormant storage.

Once Kyra has Guthrie and his box in her possession, she flees. Fortunately, she finds aid from a number of groups dedicated to the idea of individual freedom. In due time, she reaches her ship and heads for the Moon. Unfortunately, by then the Avantists have found the copy of Guthrie and reprogrammed it to be loyal to the tyrants. Fireball is being subverted by its own chief. Avantist troops are occupying Fireball facilities on the ground and in space. There seems to be no safe haven.

What can Kyra do but pack Guthrie into a message torp and launch him toward the L-5 colony along with a coded message they hope will alert someone who can retrieve him and stash him without letting the Avantists or his other—and just as capable—self twig to what is happening? Fortunately, the scheme works. Unfortunately, the other Guthrie does figure out where his original must be and sends troops to search L-5. Fortunately, Kyra by then is in the hands of the genetically modified Lunarians, elegant, sensual, and elflike, and they have schemes of their own.

The end is predictable: Guthrie is safe, and the Avantists are defeated although at the price of a war that has embittered much of Earth and left Fireball and its people outcasts. The only option seems to be surrender to Earthly control and the retreat of humanity from space, leaving it to robots.

At this point the nature of Anderson's novel changes drastically. Hitherto it has been adventure of a quite familiar sort. Such an adventure needs a quieting resolution or anticlimax, which is generally provided in a chapter or two. Anderson gives it

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a full quarter of the book and turns visionary: Let the centrist controllers and their machines have Earth and its vicinity, he has Guthrie say. The world of Demeter awaits, and though it is doomed to destruction by Phaethon, that doom is a thousand years away. That is time enough to terraform and people and build a world that can then, perhaps, move on again.

Before the end Kyra receives an apotheosis that says something quite interesting: We are our technologies, and so is our world. In this the centrist, machine-oriented culture of Earth agrees, though it emphasizes the machines. Anderson and his characters stress the "we," the living, life itself, and the life-affirming nature of technology. He crosses boundaries wherever he finds them, all to convince us that there is no distinction worth making between what we are and what we do, and that if we but follow our true nature, it will lead us to the stars and perhaps beyond.

He—along with Heinlein, Clarke, Asimov, Williamson, and many others—has been saying just that for many years. It is human nature to embrace new things, new territories, new dreams. To deny them is to deny human destiny itself.

I don't argue with this. Nor do most *Analog* readers. We're believers.

On the other hand, the shift from adventure to vision was not entirely convincing.

Not so long ago, *Time* magazine published a short story for only the second time in its history. The first time—in 1969—the author was Aleksandr Solzhenitsyn. This time, they asked Arthur C. Clarke to "give readers a snapshot of life on Earth in the next millennium." The result was "The Hammer of God," which not only snapshot life on Earth but durned near plugged it between the eyes. Later Clarke decided the story was really a compressed novel and proceeded to expand it into **The Hammer of God.**

The core of the tale is the discovery of Kali, a large rock headed for impact on Earth, and the mission to deflect it with massive rockets. Unfortunately, that tale is neither complicated nor suspenseful, despite last-minute sabotage and a luckily coincidental save in the too, too classic tradition. What gives the book much of its short length is the "snapshot of life" component, the thoughts of a giant (both in and out of SF) about the flying houses that recycle a family's wastes to provide gourmet meals, nearly human artificial intelligences, colonies on Mars and Luna, life extension, and a Spaceguard project that stations fast, powerful ships to watch the distant reaches of the Solar System for just such threats as Kali.

Kali is the first. Robert Singh, ending his long career as commander of the Spaceguard ship *Goliath*, gets the mission, and Clarke uses him as his emblem of twenty-second-century society. Through him we see houses and intelligences and colonies, and we learn—in case we have not been paying attention to the news for the last decade—all about the colossal damage that massive impacts can do

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and have done, as well as about a few very scary near misses.

Clarke's material is familiar, at least in the SF and scientifically aware communities. Outside those communities, his tone is probably too cool and cerebral to appeal were it not for his connection to that cinematic success story, *2001*. Fortunately for an unaware world, there is that connection, and Clarke's name is a name to conjure with. That is, this book will reach people who would never dream of reading a "science" book, much less SF.

One of the most popular subgenres of SF (judging from the number of titles) is action-adventure, man-against-monster, blastoffs and blasters, whizz-bang and wheee! Good, clean, harmless fun, right? Very traditional, too, since the subgenre has had its equivalent in every possible past era, when the technology was not that of space travel but of airplanes, ships, tanks, and horses, rifles, sixguns, and swords, Injuns and heretics and Huns. There was probably a version when high tech murder meant bopping someone on the head with a rock.

So what's the latest? Try William H. Keith, Jr.'s **Warstrider.** It feels a lot like the "adventure game novels" that gave Keith his start. That is, it's vigorous, fast-paced, weak on character and social realism, and not very reflective.

Here's the set-up: Humanity is in space, political power is shared by a resurgent Japanese Empire and a Terran Hegemony, and the foe is the Xenophobes, monsters that emerge from solid rock on world after world to attack and destroy civilization. No one knows what the Xenophobes are or where they come from—they have no ships, their arrivals are never detected, but there they are, all alike and defeatable only with great difficulty.

Now meet Dev Cameron. His father committed suicide to escape retribution for a militarily correct but politically unacceptable decision. Dev, in the shadow of Dad's disgrace, cannot get the slot he wanted in the space navy and must settle instead for the ground troops. At first, because he has the necessary interface to operate complex equipment such as starships, he is assigned to a strider group. Striders are combat armor; large ones are walking tanks with two and three person crews.

Alas, Dev freezes in combat. He washes out to the crunchies, infantry who go "crunch" when a strider steps on them. Only an act of heroism gets him back into the heavy equipment. At the same time, he makes a discovery that points the way to destroying the foe.

Up to this point, *Warstrider* is pretty conventional. Now it takes a sudden turn in quite another direction as aliens show up and reveal that they too are under attack by the Xenophobes. Dev is part of the volunteer force that hies off to the DalRiss homeworld, where he once again proves his heroism and discovers that the real secret of victory is not violence but communication.

The book's major problem is not

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that this insight is hardly profound, nor that the saluting trumpets sound excessively sanguine. Rather it is that sudden shift from one kind of story to another, almost as if someone had stacked two manuscripts up and called them a book. If Keith truly wishes to graduate from the game novels that gave him his start, he will have to learn to integrate his ideas a bit better. It isn't enough just to keep things moving.

Iain M. Banks is a writer of astonishing ability who has earned high praise for such recent novels as *Use of Weapons* and *Consider Phlebas*. The worlds of his imagination are marked by a wealth of detail that makes them seem quite baroque, while he structures his stories with unusual and subtle attention to misdirection. The reader thus has a certain expectation when a new Banks novel heaves over the horizon. One looks forward to a long, enjoyable visit to a realm of marvels, and when one surfaces at the end, to a sense of immense satisfaction. Indeed, that word "expectation" might better be "expectancy."

With a buildup like that, you just *know* I'm about to get nasty, don't you? Well . . .

Banks's latest novel is **Against a Dark Background.** It's thick enough to promise a long visit. It has the expected baroque feel, so if that is what turns you on, you'll enjoy the visit. But it is not so satisfying in the end. Banks fails in his subtlety and misdirection, and the tale is ultimately predictable.

The setting is the isolated Thrial star system, where humanity has existed for at least thirty millennia. The ten thousandth anniversary of the last great war is approaching, and tensions are rising. People are caching treasures and collecting antique, super-powerful weapons. Lady Sharrow, last daughter of a fallen house which once stole a Lazy Gun from the Huhsz sect, which then swore undying enmity to the family's female line, to end only with the death of the last female descendant or the return of the Lazy Gun, is a retired hunter of ancient treasures, including weapons. One of the reasons she is retired is that the last time she found a Lazy Gun, a great many people died. But now the Huhsz are taking out hunting licenses for her. She must gather her old colleagues and flee, all the while hunting for the last Lazy Gun.

She has a half-sister who is more than a little crazy and hates Sharrow yet, confined to Sea House (where the monks are tethered to slides running in tracks set in the walls), has found a clue which she hands her sister. She has a cousin with a powerful yen for her who offers quite insistently to help. She turns him down, of course, and hies off in pursuit of sis's clue. Banks uses her quest to expose us to a number of bizarre cultures, sects, and individuals. There are god-haters, solipsists, androids, and more. There is also a world where the remnants of millennia of technological culture lie thick upon the ground, as well as a flavor best described as Vancian.

And in the end, after Sharrow has been betrayed a dozen times or so,

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after she has chased and been chased, after she has shot and been shot at (not to mention bombed, beamed, and voodooed), after deaths on all sides and a pyrotechnic finale, the villain stands revealed as . . . No, I won't say, though I must note that I suspected him for well over half the book.

I was not all that enchanted to see the last page hinting that Sharrow could become the heroine of a continuing action-adventure series.

The jape is a grand tradition in SF. Sometimes it falls flat on its prat. Sometimes it succeeds wildly and hilariously. Perhaps most often the result is somewhere in between, and I am sure Lawrence Watt-Evans and Esther Friesner will not be quite delighted to hear me saying their **Split Heirs** lies in that intermediate majority. Yet their mock-heroic novel of medievaloid enchantment does lie enough toward the hilarious end of the spectrum to let me say that if you think you would love the result of a collaboration between J. R. R. Tolkien and P. G. Wodehouse, you'll love this one.

The tale opens in the Palace of Divinely Tranquil Thoughts as Queen Artemisia of Hydrangea realizes she has just been cursed with triplets, sure sign of adultery and equally sure guarantee of death if King Gudge, leader of the barbarian Gorgorians, who possesses the Queen as spoils of conquest, ever twigs. The Queen instantly instructs faithful, toothless retainer Ludmilla to schlep the girl and one boy off to the Bold Bush-dwellers in the forest so she can present the remaining boy as the new heir to the kingdom. Lackaday, Ludmilla is a mite witless as well as toothless and she hies off with both boys, meets an old friend, the shepherd Odo, drops dead in his arms, and leaves the boys to be raised in total ignorance of their true identity.

Back in the palace, Princess Arbol, perforce disguised as a boy to satisfy Gudge, turns out to be a most truly Gorgorian hellion. Prince Dunwin is raised with sheep. Prince Wulfrith is sold to a wizard and develops a talent for changing creatures great and small into other creatures. In due time, the wizard changes Dunwin's favorite sheep, Bernice, into a dragon. Dunwin hies off to find her and meets up at last with the Bold Bush-dwellers.

Meanwhile, the Queen has heard news of an Arbol lookalike and fetched Wulfie to serve as a useful standin. King Gudge drops dead. Arbol takes over the role of coronatee just in time for the ceremonial Coronation Bath, which reveals all her secrets and puts the capital quite up for grabs just as Dunwin, Bold Bush-dwellers, Bernice, and all arrive.

You get the idea. Antic, merry, not a serious word between its covers, with all the logic of classic farce. Loads of fun to write, and the main reason why I don't think it's most totally hilarious to read must be that I've been sucking too many lemons lately.

What psychological trauma could turn an ill-tempered, screaming, wailing, messy baby into that genial,

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good-humored, elfin fellow responsible for scaring half of America out of the shower and into the bathtub? The fellow in question is of course Robert Bloch, who wrote *Psycho* and a host of other horrific tales. The trauma was his encounters with *Weird Tales* and H. P. Lovecraft, and if you want to know all the gory details, you should pick up a copy of **Once Around the Bloch,** Bloch's chattily congenial "unauthorized autobiography."

Do so, and you will also learn where the *Psycho* idea came from, where the French version of the film killed the heroine, and what Bloch has done with his life, much of which has been spent writing for Hollywood.

Enjoy.

Technology and the Future, 6th ed., edited by Albert H. Teich, is an anthology of readings on the relationship between technology and society, prepared for the college textbook market. I mention it here because it seems likely to interest *Analog's* readers, many of whom are, after all, interested in precisely the theme of the book.

What do you get if you take the trouble to ask your bookstore to order a copy for you? The essays date from 1969 (Emmanuel G. Mesthene's "The Role of Technology in Society") to 1992 (Stephen J. Kline's and Don E. Nash's "Technology Policy: What Should It Do?"). There is Leo Marx's "Does Improved Technology Mean Progress?"; Howard Rheingold's "Virtual Reality and Teledildonics"; Robert A. Weinberg's "The Dark Side of the Genome"; and Lester R. Brown's (Worldwatch Institute) "The New World Order." There's a taste of E. F. Schumacher, a bit of feminism (including some insight into why "labor-saving" appliances have not liberated women from housework), and a sampling of ethical dilemmas. All in all, a short course in what the world outside SF has been thinking about the very same material that SF deals with.

There is of course a good deal of overlap. After all, SF people also read the magazines and journals and books from which Teich took his selections, and pay attention to the same issues. Yet the approach is quite different, more serious in tone, more measured, and usually less playful. It is therefore more likely to be taken seriously. It is therefore a pity—if you, like me, are a technophile—that the overall tone seems to be more than a little suspicious of the benefits of technology. ■

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BRASS TACKS

Dear Dr. Schmidt,

As one of the authors of the LUNA 2010 proposal, I appreciate both your interest in our project and the opportunity to respond to some of the concerns raised in your April 1993 editorial. The biggest concern is clearly the nationalistic character of the proposal, and it's important to understand the reason we wrote it that way: nationalism works. In order to get large numbers of people in space soon, we need to motivate the expenditure of enormous resources to the task. Historically, nationalism and self-interest have been repeatedly successful at motivating that kind of expenditure; fuzzy pan-humanism has not. If we rely on (read "wait for") international cooperation to get us into space, then the gloomy scenario you outline in "The Unreachable Stars" will probably be our fate.

There are also philosophical arguments to be made in favor of LUNA 2010. America desperately needs a new frontier, psychologically even more than physically. The American spirit developed in a climate of openness and opportunity, and is withering under the current conditions of resource scarcity, crowding, regulation, and the bureaucratic mentality. We need a frontier both as a safety valve and to stop the slide into mediocrity.

Even though it's terribly politically incorrect, I think nationalism is a good thing! Not the beat-up-on-others kind of nationalism but national pride, and spending American resources for the benefit of Americans. This used to be called patriotism, and the fact that it has been on the decline is not "progress." Except for a small number of global environmental issues, national interests diverge very quickly, and it's entirely appropriate for nations to pursue their own interests, as long as they don't initiate violence against other nations.

As a practical matter, LUNA 2010 is not about the fine points of who would control what particular orbit. There is no intention whatsoever to deny access to other nations; the proposal specifically allows for the option of ceding territory within the US region to other nations, while making no claims at all on the southern hemisphere. Having other nations on the Moon *supports* the LUNA 2010 objective, because competition is likely to generate much faster development.

It might be nice if all the people of the world could join hands and

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march off to greatness together, but given the nature of human motivation, it's just not going to happen. People do things, particularly big expensive things, because they expect to get something out of it. Americans have the option to achieve greatness in space if we can simply find the will. The alternative is to stew in our own internationalist juices, while we wait for the land to fill up and the resources to run out. Personally, I'm convinced we should opt for greatness!

TERRY C. SAVAGE
Executive Vice-President
American Space Council
1595 Shanghai Circle
San Jose, CA 95131

If you see only one ("the") alternative, that is a significant problem in itself. I did not say anything against national pride, or even against the concept of nations claiming or owning land on the Moon; I did expressly acknowledge that there are problems with the present "Moon Treaty" approach. I agree that a better alternative is needed; I don't agree that Luna 2010 is the best we can do in finding such an alternative. And I notice that your response does not address—at all—my complaints about the sheer magnitude *of the land grab you propose. "There is no intention whatsoever to deny access to other nations" is hollow reassurance in this context;* you *may have no such intentions, but where is the assurance that your successors won't? So I repeat: we need something better than the Moon Treaty—but we also need something better than Luna 2010.*

* * *

Dear Dr. Schmidt:

L. Sprague de Camp made several worthwhile, though certainly not new, points in his article "Goat Island" (April 1993), but he also repeated a common error that needs constant correction.

The Biblical commandment (in Exodus 20:13) that he cited as being "Thou shalt not kill" is an inaccurate translation in the King James Bible (and even some other versions), which has misled countless people, religious and otherwise, for centuries. The correct translation, as anyone familiar with the original Hebrew can tell you, is "Thou shalt not murder" (to specify immoral killing, not all killing.)

M. RUSSELL
Los Angeles, CA

Dear Stan:

First, thank you, thank you, thank you! Thanks for going back to the non-damaging gummy labels. I really appreciate it! Now to the meat of this letter:

After having read "Goat Island," I'm left with a few minor quibbles, and a major one. First, the minor: Yes, you can grow food where you have built houses, roads, factories, and so forth. You need only do it on the roof. This planet is three-dimensional, you know! Second, de Camp's dismissal of the population absorbing capacity of space was too pessimistic. Pessimistic because he assumes that the people would have to live on the surfaces of planets and moons. As has been known for decades, that's a very inef-

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ficient use of mass for living space. Ceres alone, converted into O'Neil type space habitats, could support a population many times that of the Earth, at hunter-gatherer population densities. You'd probably have to mine Jupiter for the volatiles. I'll grant you, space is not a near-term solution to population problems.

The major problem is that in a 17-page article on population growth, the phrase "demographic transition" did not occur once! You'd never realize from reading this report that Americans (on average, and that's a very important detail) don't have enough children to replace themselves. Only immigration and a skewed population distribution (thanks to the baby boom, and its echo) are keeping our country's population from shrinking. The same is true of the other industrialized nations. It's something Malthus never realized—well off, educated people don't have very many children. Children cut down your living standard!

Placed in an evolutionary perspective, this makes sense. There was no such thing as birth control when we evolved. And so, rather than a drive to have children, which would be complicated, we have evolved a drive to engage in sex, which is simple, and would, absent technology, inevitably lead to children. We also have a drive to better our circumstances. Add enough technology to the mix, and our drive to better our circumstances leads us to use birth control, and avoid having children. I think the real question is, do we have enough of a drive to reproduce, rather than simply engage in sex, to avoid dying out altogether once our material needs are fulfilled?

And so, I'll make a somewhat tentative prediction of my own: A couple hundred years from now, people will still be talking about the "population problem." But they won't mean the same thing by it!

BRETT P. BELLMORE

8750 Burt Rd.
Capac, MI 48014

P.S. Speaking as a gun owner, I do not in the least appreciate having gun ownership compared to racial prejudice. Based on my experience, there is at least as much fanaticism to be found among gun control advocates, as among gun owners, and a great deal more prejudice. Indeed, what is gun control, except prejudice? It is, at its very heart, prior restraint, and involves abandoning any pretense that gun owners shall be treated as "innocent until proven guilty." Finally, I'll note this: Advocates of gun control may insist on finding the 2nd Amendment ambiguous, though the rules of grammar do not. Nobody in their right mind can find the writings of the authors of the Constitution on the subject of gun control ambiguous. Which perhaps explains why, in their attacks on the 2nd Amendment, people such as de Camp never quote Madison (the author). Hmm, am I sounding a bit fanatical? Anyway, you get my drift.

Dear Stan:

"Goat Island," by L. Sprague de Camp (April '93), struck me as dated. Sure, no one contests that humans are

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ultimately limited by the laws of nature like everything else; and certainly population can't rise indefinitely. But de Camp focused on the biology, to the exclusion of the demography and the economics, and thus painted a very incomplete picture.

In fact, one prediction of Malthus's has proven to be completely wrong: he assumed in the *Essay on Population* that birthrates would rise with income. Exactly the opposite has happened in every society that has become wealthy enough. Western Europe's birthrate has been trending downward for over a century. Indeed, Europe's total fertility rate is now below the replacement level, and is still trending downward with no limit in sight (e.g., Coale, 1986[1]). (A population bust in a few centuries? That scenario is probably Politically Incorrect even for science fiction, but that doesn't mean it isn't possible.) Contrary to de Camp's implication, there is *no* biological check on such a scenario, too, as it would be an artifact resulting from humanity's intelligence coupled with an unprecedented social situation. Hence there's been no selection pressure against it. In fact, in a purely Darwinian sense, the fact that an individual's short-term concerns can override reproduction to the point that total population declines is a profound maladaptation! But it's not generally one you hear about when reading of the biological problems engendered by *Homo sapiens*'s experiment with a large brain.

Most of the "immigrant" tension in Europe now results from this demographic fact: from the collision between wealthy, declining, and aging populations that need labor, and the very different ethnic, racial, and religious background of the much poorer immigrants who are willing to supply that labor.

Now, I wouldn't gainsay that there exists a biological desire for children (as distinct from the mere desire for sexual activity), but here again de Camp underestimates the effect of economic considerations in human affairs. Children have traditionally been not just the by-product of sexual activity but economic assets; a labor force on the farm, and an old-age pension. In modern societies, however, a child is a significant *cost*, a discretionary expense as much as (say) a boat or a vacation home —with the result that the birthrate plummets. People, not being nearly so stupid nor such slaves to their biological programming as the "elite" seem to think, realize this and try to limit their families accordingly as their income level rises. (John Barnes discussed some of these points in his article "How to Build a Future," *Analog*, Mar 1990; since reprinted as one of the Pulphouse Publishing's Writer's Chapbooks.) To which point, of course, it is certainly true that women (and it's generally women as they most often suffer the economic consequences) may wish

[1]Coale, A.J., The decline of fertility in Europe since the eighteenth century as a chapter in human demographic history, in *The Decline of Fertility in Europe*, Princeton Univ. Press, 1986.

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to limit their birth rate but be unable to do so, because of ignorance or lack of access to effective birth control techniques. Moreover, political chaos in certain parts of the world maintains the incentive for people to have large families, despite its undoubted long-term cost, simply because they cannot rely on the larger social and political system for support (see, e.g., Mann, 1993[2]).

But the way toward stabilizing world population is to provide education, access to birth control (you can trust that people will use it; they're very good at perceiving their self-interest), and the chance of upward mobility—and also to remove perverse incentives for continuing to have large families, by promoting political stability instead.

Hence, many of de Camp's parenthetical asides on "what should be done" would merely exacerbate population growth. His comment on immigration into the US, for example, is naive; as in Europe, the immigration is driven by demography and economics, by the juxtaposition of a wealthy declining population in need of cheap labor and a poorer one willing to supply that labor. The way to cap Mexico's population is to let them become wealthy, too! And keeping them out isn't going to help do that.

Moreover, to the extent that casual statements such as "sending such countries [like Haiti or Bangladesh, which are close to famine] foreign aid or medical assistance merely aggravates the population problem" are taken seriously, they are counterproductive because they make the world even less stable politically. Again, people are very good at perceiving their self-interest; when they see that children are not economic assets, and if they've access to means of limiting their birth rates, they *will* limit their birth rates. All by themselves. It's happened over and over.

So yes, population growth is a present problem; but the long-term outlook is not merely so bleak as de Camp presents. Worse, his proposed "solutions" are unlikely to improve matters; in fact, they'll make things worse.

STEVE GILLETT

Good day, Dr. Schmidt:

Reading "Squatter's Rights" (3/93 & 4/93) by Maya Kaathryn Bohnhoff was a joy. It took no time at all to see *where* she was going—her hopes, dreams, visions are no mystery, for I share them. But, then, much of the fun for me is in watching *how* an artist gets where she's going. And Ms. Bohnhoff gets there so well, so creatively, so entertainingly. Since I spent little energy wondering where she was going, I could spend it all rooting for her to get there. What a wonderful sense of positive anxiety that produces.

I had one nit to pick as I read. A two-word nit. In a story spanning two issues a mere piffle, but an image I'd like to share. Near the end of Part I, when Rhys likens the Tsong Zee quest to religious pilgrimages on

[2]Mann, C.A., How many is too many?, *The Atlantic*, Feb. 93, p. 47 ff.

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Earth, he says: "Tson is Mecca; it's Bahji; it's Mount Carmel." Instead of Mount Carmel, I feel a better comparison would be Jerusalem. Not being Muslim, I can never go to Mecca. But having visited all three Holy Land sites, I see Jerusalem and Bahji (like Mecca) as culminating points of pilgrimage, while Mount Carmel is a threshold for pilgrims who will attain their final goal in either Jerusalem or Bahji. A minor nit, but a very different-feeling image.

Speaking of religious comparisons, and because I do want you to keep on publishing the pieces that make us think, I also want to comment on L. Sprague de Camp's 4/93 science fact article "Goat Island." Boy, was that one guaranteed to make me think. Of course, I don't agree with all Mr. de Camp's ideas; but, then, that's *why* it made me think, and I want to thank him for that. I don't take offense at ideas I don't agree with; if everyone were always to think as I do, I'd never learn anything.

But I was bothered by the way he states one comparison. In referring to conflict control with those outside of as well as within a group, he says: "Buddhism is more universally benevolent in this matter than any of the three great monotheisms." I think he's referring to Judaism, Christianity, and Islam. But if so, by what criterion does he consider them the only "great monotheisms"? There are others. For that matter, why does he imply Buddhism is not one? Just because Buddhism semanticizes its theology in a manner unfamiliar to the West, that's no reason to exclude it. Where the Christian speaks of the Will of God, for example, the Buddhist speaks of the Will of Heaven. Still singular, still supreme; they are invoking the same thing. Furthermore, all four of these Faiths (and others) are, I think, equally benevolent in this matter; it's "followers" who have lost sight of the principles of their Faiths that are so often less than benevolent.

Come to think of it, if I can only complain about two sentences out of two whole issues of your magazine, you all are really batting a thousand with me. Keep up the good work, and keep making me think . . . and care.

LUCKI M. WILDER
7408 North Rogers
Chicago, IL 60626-1610

Dear Stan:

Further comment on Vincent Di Fate's excellent article on the Cape, and his eloquently cogent defense of NASA seems almost redundant. Still, I think a few words on my own experience with NASA might add another dimension to the appreciation of NASA's problems.

Twenty years ago I was annoyed at the apparent lack of enthusiasm for the space program, and with the help of the Chesapeake, Virginia School's Graphics Department, produced a set of six posters promoting the space program—which, by the way, earned the students several important awards for graphic excellence. This set of posters was designed as three for collectors, three for propaganda, and sold to the public at a price almost sufficient to offset the cost of production and postage.

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The public response was wonderful. I received hundreds of letters detailing how the buyers intended to display them for greatest exposure.

We wanted to make a presentation of a number of them to NASA, for its own use: seemed like a good idea at the time. NASA's response was quite a surprise: "These posters are very nice, but you are *selling* them to the public. That makes it a *commercial* venture, and we are not permitted to accept donations of that type."

All of us were somewhat taken aback. Several months went by, and a new letter arrived from NASA's education department.

"We happen to have fifty dollars not specifically allocated in our budget... How many sets of posters can we get for fifty dollars?"

Our answer was fast and succinct—"How about five hundred sets?"

NASA used them in traveling programs for several years—and got a number of refills. And they are *still* selling, slowly but regularly, twenty years later, perhaps because the message becomes increasingly important as time goes on a-wasting.

When I was commissioned to do the mission patch for Skylab One, [see *Analog*, June, 1973] I didn't even try to promote the attendant poster through NASA. There were only about 500 Skylab posters printed [they were already collectors items] and I simply sold them direct —largely by word of mouth.

I think there is in fact no lack of public interest—consider only the popularity of science fiction oriented TV and cinema. But it is hard to maintain the desirable level of excitement in the public when competing for news coverage with riots, earthquakes, bombings and other general mayhem. And when repeated budget reallocations, personnel changes, and elections cause every NASA promotional program to go back to square one every six months or so, it's hard for even the best bureaucrat to keep even with the game.

The situation is *not* under control: it is becoming more critical by the day. We should be infinitely grateful for the dedication of such people as Vincent Di Fate, and Bob Shulman, and pray devoutly that they can somehow be provided a wider audience.

KELLY FREAS ■

Everyone complains of his memory, and no one complains of his judgment.

Duc de la Rochefoucauld

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UPCOMING EVENTS Anthony Lewis

26-28 November
LOSCON 20 (Los Angeles area SF conference) at Airport Hilton, Burbank, Calif. Guest of Honor: Roger Zelazny; Fan Guest of Honor: Paul Turner. Registration: $25. Info: Los Angeles Science Fantasy Society, Inc., 11513 Burbank Blvd, North Hollywood CA 91601.

26-28 November
Darkover Grand Council Meeting XIV (emphasizing the work of Marion Zimmer Bradley and similiar writers) at Timonium, Md. Guest of Honor: Elizabeth Moon. Registration: $25 until 1 November, $30 thereafter. Info: Armida Council, Box 7203, Silver Spring MD 20907.

24-25 December
POLECON '93 (High Arctic SF conference) at the Workshop, Ninety North. Guest of Honor: Kris Kringle; Fan Guest of Honor: Frosty; TM: Bob Tucker. Registration limited.

14-16 January 1994
CHATTACON 19 (Tennessee SF conference) at Chattanooga, Tenn. Guests of Honor: Terry Prachett, Dean Ing. Registration: $18 until 15 November, $25 until 1 January. Info: Box 23908, Chattanooga TN 37422-3908.

18-20 February 1994
BOSKONE XXXI (New England SF conference) at the Sheraton Tara, Framingham, Mass. Guests of Honor: Emma Bull & Will Shetterly; Official Artist: Nicholas Jainschigg; Special Guests: Patrick & Teresa Nielsen Hayden. Registration: $30 until 15 January, more at the door. Info: Post Office Box 809, Framingham MA 01701-0203.

1-5 September 1994
CONADIAN (52nd World Science Fiction Convention) at Convention Centre, Winnipeg, Manitoba. Guest of Honour: Anne McCaffrey; Artist Guest of Honour: George Barr; Fan Guest of Honour: Robert Runté. Registration: $85 (C$95) adult, $30 (C$35) child until 30 September 1993, Supporting: $25 (C$30). This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Join now and get to nominate and vote for the Hugo Awards and the John W. Campbell Award for Best New Writer. Info: Conadian, Box 2430, Winnipeg MB R3C 4A7 Canada or Box 7111, Fargo ND 58109 (204) 942-9494; FAX (204) 942-3427. ■

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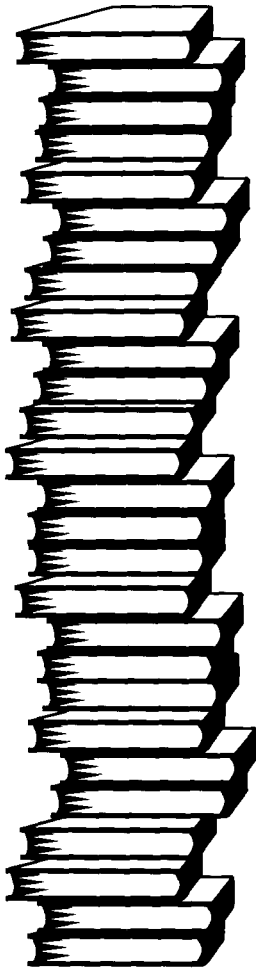

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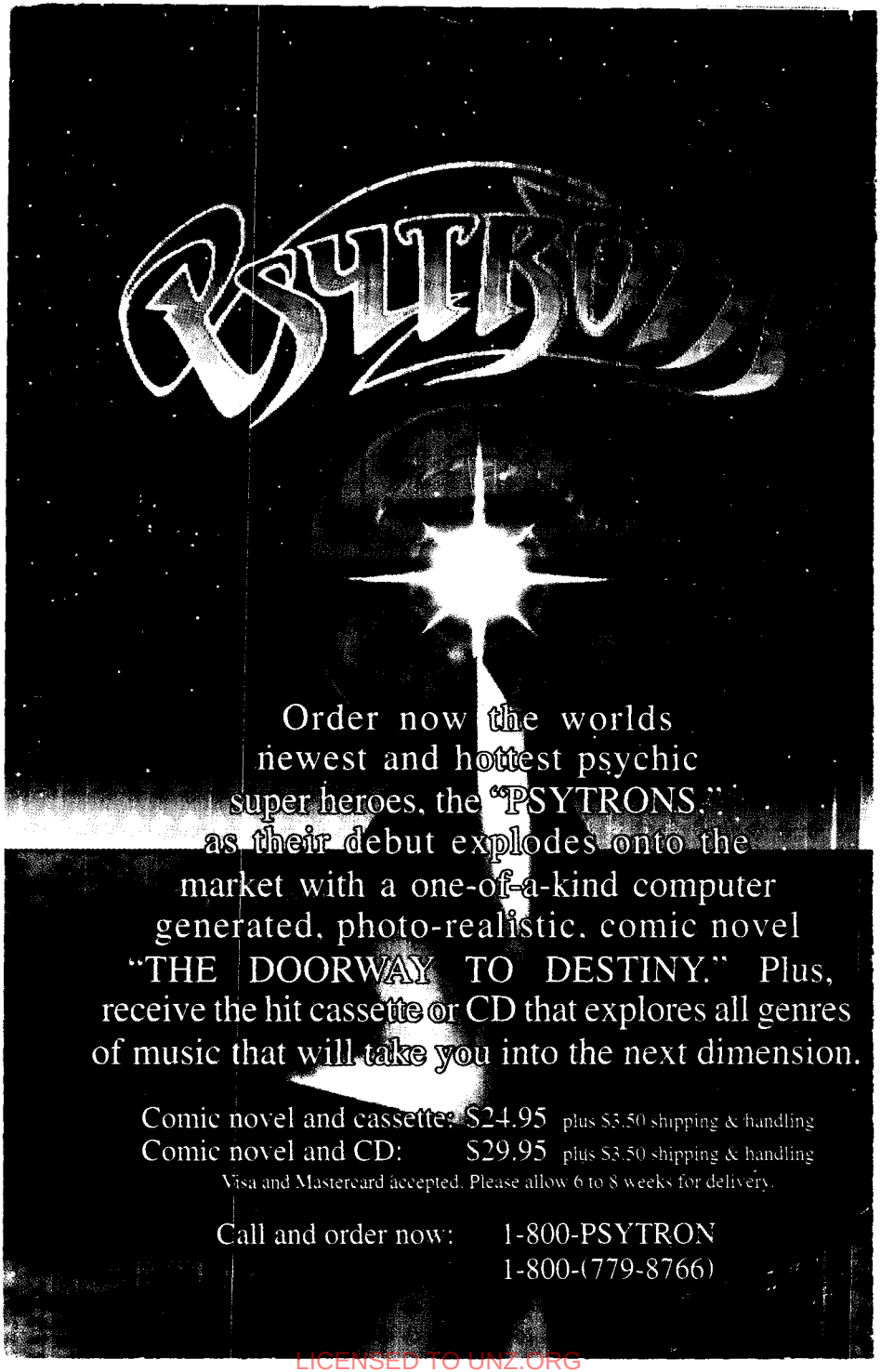
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